THE

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A NEW RESEARCH LABORATORY.

THE formal inauguration on Tuesday last of a large and well-equipped Research Laboratory is an event of more than ordinary importance. Research departments exist, and have existed for many years, in several of our large manufactories—the General Electric Co. itself has quite a notable one at its Witton Works—but the Wembley establishment is the first instance known to us in which a British firm has erected and equipped so large a building for the sole purpose of research.

The essential importance of conducting original investigations with a view to the improvement of manufactured products has been appreciated by far-sighted industrialists and preached by the technical Press for many years, but it was not until the war made research a matter of life or death for the nation that the truth was brought home to the public understanding. In that stupendous struggle it was abundantly demonstrated that British scientists and technicians were at least equal, and probably on the whole superior, to those of other nations; problem after problem of vital importance was placed before them for solution, and solved not only successfully, but speedily. Time after time they outpaced their rivals, and where the latter did secure a lead, our researchers quickly unravelled their secrets. Thus even the British Government came to realise the value of research and established a special department to encourage and assist its development, with the special object of promoting trade after the war. Excellent work has been accomplished by that department, but it has always been fully recognised that research on the part of individual firms capable of supporting the attendant expense is necessary in addition to that carried on by the research associations. Moreover, the results obtained by foreign competitors by means of their research departments have afforded a continual reminder that we must emulate their example or pay the penalty of loss of trade.

We most cordially welcome, therefore, the establishment of this new laboratory by the General Electric Co., Ltd., which is, moreover, to be congratulated on placing it in the charge of Mr. C. C. Paterson, whose long and distinguished service at the National Physical Laboratory was not only a guarantee of his ability but also a most admirable preparation for the work. Mr. Paterson also is to be congratulated on his good fortune in being at the head of such an establishment; it is not given to every man to combine business with pleasure, but we are sure that he takes as much pleasure in his daily occupations as in his favourite recreation. Moreover, he has made excellent use of the opportunity of demonstrating that, contrary to the popular but wholly erroneous impression, the scientific mind is as efficient in the work of organisation and administration as in research—for it will be difficult to find an establishment more admirably adapted to its purpose or more ably conducted than the Wembley Laboratory.

It is to be hoped that, whilst giving due attention to the needs of "industrial research," the company will

not ignore the importance of what is known as "scientific research"—a palpable misnomer, for all research that is research is scientific. What is meant is research directed purely to the advancement of knowledge, without an immediate practical application in sight. The latter will follow in due course. Faraday, whose discoveries laid the foundations of the electrical industry, never troubled about the mode of utilising them. When we consider how enormous has been the influence of British research upon the progress of civilisation, we may look back with pride and forward with confidence. We have not the slightest doubt that the outlay incurred by the General Electric Company on this establishment will be amply repaid, if the broad view is taken and research is not restricted to questions of the hour.

So far as the latter are concerned, the matter is not open to question. Mr. Christopher Wilson, director of the Osram Works, has stated that since organised research was begun at his works, his difficulties have melted away, guessing at their cause has been replaced by accurate knowledge, and progress can be made with confidence.

Industrial Research.

Whilst the foregoing is a notable instance of private enterprise in connection with research, the value of co-operative research has been most opportunely demonstrated by the presentation of the second report on the heating of buried cables at a meeting of the Institution of Electrical Engineers which took place yesterday. This report covers investigations which have been carried out at the National Physical Laboratory and at Newcastle-on-Tyne on behalf of the British Electrical and Allied Industries Research Association—under the ægis, therefore of the Institution and the B.E.A.M.A.—and embodies tables of the maximum permissible currents for all the sizes and types of paper-insulated cables in general use which have been standardised by the B.E.S.A. It is a most comprehensive document, containing 64 tables and 41 figures, and occupying 59 pages of the I.E.E. *Journal*. In addition to the actual data which are tabulated, there is a mass of information bearing on the subject, which reflects great credit on the investigators.

Whereas the results obtained in a private laboratory are available only to the proprietors, the report of the Research Association is open to all; and we have the best authority for asserting that the data thus obtained are of such immediate value and importance, that the saving effected by a single undertaking on the strength of these figures in one year may readily be *more than sufficient to cover the whole cost of the investigation*. Thus it will be seen that users as well as manufacturers of cables stand to benefit enormously by these researches. When we estimate on this basis the value of the work to the British electrical industry in the aggregate, it will be seen that our oft-repeated assertion that outlay on research is a most profitable investment is abundantly justified. The moral is obvious: let us cultivate research by every possible means; its immediate returns will justify the expense, and the future benefits derived from it will be incalculable. But the first of these items is the expense, and it is incumbent upon all parties—manufacturers, users, and the Government Department of Research—to see to it that ample funds are made available for so worthy an application.

I.E.E. Proceedings.

The Council of the Institution is to be congratulated on providing a most interesting and instructive programme for the special meeting on Thursday last week. First, Dr. H. W. Nichols, who is in charge of the investigations into transatlantic telephony that are being carried on by the International Western Electric Co., gave an excellent *résumé* of the subject, explaining, without going into too great detail, the remarkable system which the company has devised for enormously increasing the efficiency of transmission. The principles adopted were set forth in our issue of January 19th; briefly, the basis of the scheme is to restrict the transmission to essentials. If we could write a letter on paper in New York, remove the paper and *transmit the writing alone* across the Atlantic, and then catch it in London and affix it to paper again, we should be doing for the eye practically the same thing that the company is doing for the ear. The difficulties that are met with are mainly due to natural phenomena, particularly the enormous variations of the absorptive properties of the space between the two continents from day to night and from winter to summer, which were admirably illustrated by curves which Dr. Nichols threw on the screen.

Then Mr. B. Welbourn, appearing for the first time as chairman of the new Liverpool Centre, and *ex officio* member of Council, exhibited two kinematograph films which, as he said, represented a change of subject (from feeble pressures measured in microvolts to a pressure of 100,000 volts) "with a vengeance"; for he took the crowded audience in fancy over the Rocky Mountains on the Chicago, Milwaukee, and St. Paul railroad, with the aid of electric locomotives weighing 280 tons and hauling trains of ten times that weight up grades of 1½ per cent. No better demonstration could have been given of the importance of this vast scheme of electrification, embracing a length of route as great as from Land's End to John o' Groats. The primitive overhead construction carrying the 100,000-volt mains and the trolley wires, on wooden poles felled in the nearest forest, afforded an object lesson of what could be done with simple means, yet without sacrificing efficiency or reliability. In this old country, where Board of Trade rules have governed the construction of railways and overhead lines, standards have been evolved which are nowhere surpassed in stringency, but which, unfortunately, are equally unrivalled in costliness. Those of our engineers who may be called upon to lay down new railways and power schemes abroad should see these films, and learn that methods which are suitable for this country may be wholly inapplicable to foreign conditions.

The British Industries Fair.

While at the Birmingham section of the Fair recently we found that it was the general opinion that the present practice of holding the exhibition in February and March needed careful revision, and we mentioned in our last issue that next year, particularly, a later date would be preferable in consideration of the foreign visitors who will want to attend both the Fair and the British Empire Exhibition. We are therefore glad to learn that the Council of the Birmingham section has definitely decided that next year's Fair shall be held in May; the decision appears to have been taken with more regard to the probable weather conditions than to the Wembley exhibition. The London portion cannot, however, be brought into line with this arrangement owing to the White City buildings being required for other purposes during May, and thus the 1924 Fair will be more than ever two separate fairs.

These arrangements may be considered by some to be premature, having in mind the pronouncement of Sir W. Joynson-Hicks, Parliamentary Secretary of the Department of Overseas Trade, at a recent dinner in London. He implied that, perhaps, the business resulting from the Fair was below anticipation, but pointed out that, after all, the Government did not wish to press the Fair upon manufacturers. If the latter found that it did not pay, it would have to be abandoned. It had been an attempt on the part of the Government to help trade, and he thought that it had achieved a large measure of success. He further considered that the British Industries Fair would not conflict with the

British Empire Exhibition; whereas the former was purely a business organisation, the latter was a "great Imperial gesture."

We do not anticipate much disagreement with the first decision; the other problem is one requiring far more consideration.

It cannot be gainsaid that there has been a falling-off in both the exhibits and the attendance at the last two Fairs. Of course this may be merely another reflection of the general condition of trade, and it is possible that with a slight revival this valuable means of revival may be considerably improved.

Whatever the conditions and their reasons, the question has been asked: "Is the Fair worth while?" and a definite answer is expected from those who possess the experience gained from previous Fairs. We have no doubt that the Department of Overseas Trade and the Birmingham Chamber of Commerce will take the necessary steps to ascertain the general view and act accordingly.

Training in Illuminating Engineering.

The discussion on the above subject at a recent meeting of the Illuminating Engineering Society covered wide ground. In one sense we should all be "illuminating engineers," for there is no one who is not in some degree interested in illumination. The authors of the paper, Mr. C. E. Greenslade and Mr. J. E. S. White, did not confine themselves to courses on illumination at technical colleges, but dealt with the arrangement of more popular lectures for the benefit both of adults and of children in schools. There are many classes of the public who have much to do with lighting, but understand little about it, and it would certainly be advantageous if the importance of the subject could be brought before them in a vivid form. Miss E. Squire, who is associated with the Factory Department of the Home Office, made some very pertinent remarks in the discussion regarding the education of managers of factories and workers. It is common knowledge that while some factories are admirably lighted, there are others in which the fundamental points in good lighting are still strangely ignored. As regards courses in colleges, there seems to be a general impression that the time is not yet ripe for a complete Illuminating Engineering Department. The most hopeful line of development seems to be in improving the sections of existing courses that deal with lighting. The authors were right in drawing attention to one weakness in some curricula—the tendency to treat the subject too much from the physical side. Photometric experiments in colleges are often too academic. Students should learn from the use of illumination photometers the drawbacks and merits of various systems of lighting, and lecturers should deal largely with practical applications of light rather than with lamps or physical phenomena. We notice that the Illuminating Engineering Society has received an encouraging response to the queries which it has addressed to leading technical colleges, and we hope that its influence will help towards bringing the treatment of illumination up to modern requirements.

Germany's Network of Generating Stations.

Attention was recently directed in this journal to the large capital increases which took place in the German electrical manufacturing industry in 1922. These augmentations, however, were far outstripped by the capital transactions which were carried out last year by the large group of works represented by big power stations and hydro-electric works, comprising both new undertakings and the extensions to existing works. State participation—that is, Federal State participation—has been the dominant factor in many of these cases. Special activity in this direction has been displayed by South Germany where, although coal resources are lacking, there exists an abundance of water power. The original estimates for the execution of the schemes have turned out to be too optimistic owing to the heavy depreciation of the mark, and it has therefore been necessary in different instances to make considerable additions to the capital of the undertakings concerned. Taken in their order of magnitude of capital expenditure, it would appear that the undertakings in the State of Bavaria occupy the first place; Baden comes second, and Wurtemburg third, these being followed by the district of Berlin, Central Germany, the East and the North and Westphalia. A list of the individual developments in each of these areas shows that Germany is fairly quickly being covered by a great network of generating stations, the erection and equipment of which are affording a powerful stream of orders to the manufacturers and constructional firms. Technical problems are also being advanced through the execution of the works, particularly in regard to the hydro-electric works; and in the final result the costs of industrial production will be reduced by the expansion of the use of electrical energy. It is assumed that this high period of favourable trade will not fail to be followed by reaction and disillusionment, especially in the case of the water powers which exhibit caprices in summer and winter. But it is considered that the favourable effects of the whole development will only be manifested with great emphasis when normal conditions in general have been restored in Germany.

Russian Supply Works and Manufacturing.

Dealing in a Russian newspaper with the question of the electrical manufacturing industry and the work of electrification, Mr. E. Perelman refers to the practice of the Berlin A.E.G. in pre-war times of constructing electricity supply stations with the company's own funds and of then transferring them to separate companies, in order constantly to release the company's funds for the carrying-out of new undertakings in the same or a similar direction. All these undertakings were kept as permanent customers for the manufacturing works of the originating firm, which retained, directly or indirectly, financial control over the separate companies.

This tendency was also observed in Russia as a result of the activity of German manufacturing firms in that country years ago. Thus in the period from 1900 to 1914 German capital invested in the electrical industry in Russia was represented by 118,344,000 gold roubles, of which 85,290,000 roubles, or 72 per cent., applied to the electricity supply works. It will therefore be seen that the German manufacturing firms, which owned the manufacturing works in Russia, were compelled to invest about three-fourths of their capital in supply undertakings in order to guarantee themselves orders for their works.

The total capital, both native and foreign, invested in the Russian electrical industry in pre-war times amounted to 375,000,000 gold roubles, of which 290,000,000 roubles, or 78 per cent., represented electricity supply works. Foreign capital in itself formed 243,000,000 roubles of the former, and of this sum 192,000,000 roubles, or about 80 per cent., was locked up in electricity supply undertakings. Thus in order to promote the sale of their manufactures, foreign manufacturing firms had to extend their activity to the work of organising the electricity supply industry, and in this manner they provided a way of helping themselves. In other words, the capital invested in these undertakings creates a demand for motors, installation work, lamps, &c., and the value of the demand thus produced is stated to be at least twice the amount of the capital invested in the supply works. Instances of the extent of such demand are afforded by the generating stations at Moscow and in other centres.

Mr. Perelman concludes from these circumstances that in order to develop the native manufacturing industry, all the efforts of the Russians ought to be devoted to the construction of new supply stations and the extension of those already in existence, there being, in his opinion, no other alternative if this object is to be attained.

NOTES ON ELECTROLYTIC RECTIFIERS.

By MORTIMER A. CODD, F.Ph.S.

Attempts have been made from time to time to utilise the asymmetrical properties of the aluminium cell for commercial purposes, but without any marked success, especially in this country.

Anything but general information on the subject seemed to be rather meagre, so experiments, of which the following is a brief summary, were undertaken.

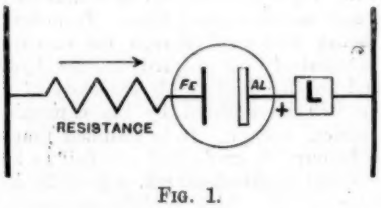

Fig. 1.

The simplest circuit is depicted in fig. 1, in which a single cell is in series with the source of supply and the load.

Fig. 2 shows the Wheatstone bridge or Gratz method employing four cells, and fig. 3 a modification using three cells that the writer has found satisfactory for this type of arrangement.

Fig. 4 illustrates the "middle point" system of connection utilising two cells or one cell with two aluminium electrodes.

The simple circuit (fig. 1) is inexpensive, but only utilises one wave of the source of supply, and does not entirely suppress the other (inverse); moreover, if the load requires only a small pressure (as with small accumulators and the like) compared to the pressure of the mains, the arrangement is very wasteful. The same remarks also apply to arrangements 2 and 3, except that these methods utilise both waves of the supply current.

Fig. 4 is the system usually preferred for small load pressures in that, as a middle point is necessary, a transformer or auto-transformer is essential, and tappings can be taken off, so that the voltage of supply approximates to that required by the load.

It will be noticed, however, that since there are two

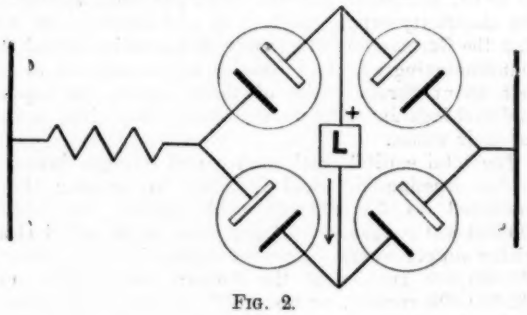

Fig. 2.

tappings besides the middle point tapping, the total voltage is twice that of the load voltage. As soon, therefore, as the voltage of the load approximates to half the mains voltage, the bridge method is probably indicated, although the transformer can also be utilised to step up the voltage as well as to afford the middle point.

In such a case the deciding factor would probably be the cost of apparatus and the duty it has to perform.

As electrolyte, the following salts were examined, the electrodes being aluminium and iron:—Potassium phosphate, sodium bicarbonate, ammonium phosphate, ammonium bicarbonate, potash alum, sodium phosphate, ammonium molybdate, ammonium borate, potassium bitartrate, sodium silicate, and hyposulphite of soda.

The connections were arranged with a single cell in series with a fixed non-inductive resistance as load, on mains at about 18 volts pressure, having an oscillograph, a permanent magnet, and hot wire ammeters in circuit.

The following table gives data of some of the most successful salts and one whose qualities are poor. (The wave-forms are shown in fig. 5):—

1	2	3	4	5	6	7	8	9
Salt.	Amperes.		Rectification Ratio PM/H.WC	R.M.S. Volts over Cell.	Peak Volts over Cell.	Current at 12 Volts.		Apparent Resistance.
	H.W.	P.M.				Major Direction.	Inverse.	
1. Potassium Phosphate	3·5	1·8	51·4	14·75	10·7	8·8A	·0024	5,000 ohms.
2. Sodium Bicarbonate	2·65	1·4	52·8	15·5	13·0	4·6	·0011	10,900
3. Potash Alum	2·25	1·1	48·8	16·25	15·9	3·3	·0014	8,570
4. Ammonium Phosphate	2·25	1·1	48·8	16·0	15·1	8·0	·0009	13,330
5. Ammonium Bicarbonate	2·02	·95	47·0	16·75	16·6	8·0	·0015	8,000
6. Sodium Phosphate	2·05	·9	43·9	16·0	15·4	2·5	·0017	7,050
7. Potassium Bitartrate	·55	·4	72·7	18·25	22·3	·25	>·100	—

Column 2 gives the total R.M.S. current flowing through the cells, and column 3 the unidirectional current.

It must be remembered that the R.M.S. current is the whole current in whatever direction, whereas the current read by the permanent magnet instrument indicates unidirectional current only, the meter having subtracted inverse current, if present, when giving the reading.

It must be further borne in mind when comparing the results that whereas the hot-wire instrument reads the root-mean-square, the permanent-magnet instrument reads the arithmetical mean; nevertheless, such a comparison (column 4) gives a rough indication of the

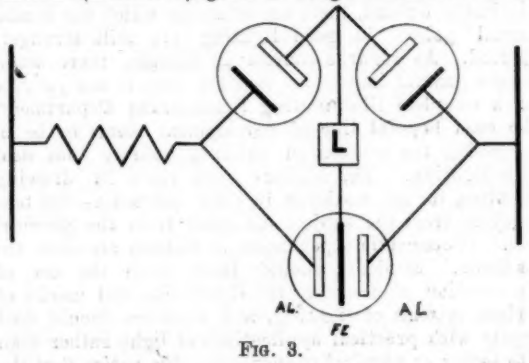

Fig. 3.

rectifying properties of the cells. For use in charging secondary batteries and the like, the readings of the permanent-magnet instrument seem to give the nearest reading to the electrolytic mean, and should therefore be used.

Column 5 gives the voltage measured by a hot-wire voltmeter over the cell, and column 6 shows the peak value over the cell in volts as measured by the oscillograph.

After the experiments detailed above, each cell was connected direct to a 12-volt accumulator of large capacity, and the current measured through the cell in the major direction (column 7) and in the inverse direction (column 8). The direct readings afford some idea of the conductivity of the cell in the major direction and agree fairly well, but the inverse readings are not so easily determined, particularly in some cases, as the apparent resistance (column 9) increases with time, so that only the resistance at the point of time of current reversal is really of use.

The cell with which these experiments were conducted held roughly two pints, and approximately saturated

solutions were used. The electrodes of iron and aluminium had an effective surface of 11 sq. in. each, and were about 2 in. apart.

New aluminium plates were used for each experiment. The strength of the electrolyte and the distance apart of the electrodes does not seem to matter within fairly wide limits, provided the current density per sq. in. is not too high.

In comparing the results above tabulated, too much importance must not be attached to the apparent conducting properties of the cell, since various other factors play a preponderating part, and some of the salts giving the best results are subject to other disabilities.

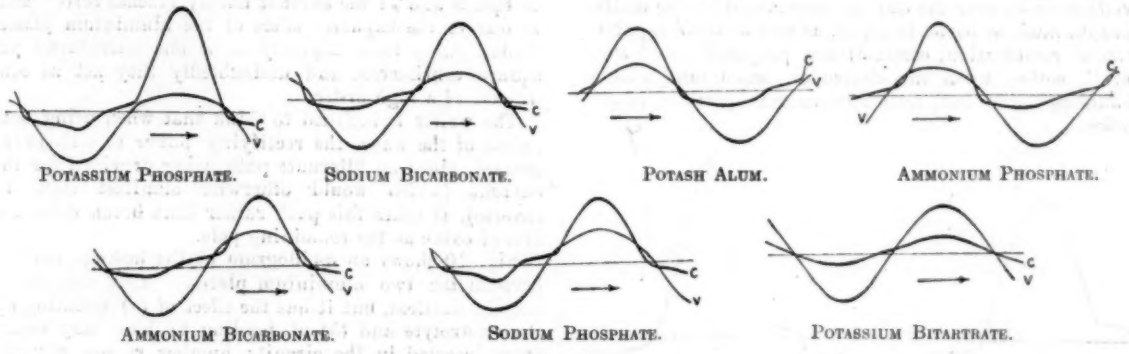

Fig. 5.

Thus *potassium phosphate* is relatively expensive and, being a deliquescent salt, is not easily stored commercially; apart from this, however, it gives excellent results.

Sodium bicarbonate is cheap and easily stored, and of all the salts examined appears the one to give the best all-round results. It has, however, the bad property of "snowing up"; that is, dense quantities of aluminium hydroxide form on the surface, tending to make the cell heat up. This heating-up of the electrolyte is the weak spot with electrolytic rectifiers, since when once the temperature has reached from 110° to 120° F., rectifying properties steadily depreciate, and in rectifiers employing more than two electrodes (figs. 2, 3, 4) the current leaks directly across between the cathodes.

Thinking that perhaps the current density was too great and accounted for this heating, the writer repeatedly increased the size of the electrodes, with the result that the deposit on the plates became heavier than ever and the heating-up was aggravated.

The strength of solution of sodium bicarbonate was next varied from very weak up to saturation (about 16 oz. to the gal.); but any solution stronger than 8 oz. to the gallon appears to work equally well. The next experiment was to reduce the size of the plates, when a marked improvement was noticeable, the best point being in the neighbourhood of 12 sq. in. active surface per ampere.

It should be stated here that the writer tried removing the white oxide from the aluminium, first by chemical and secondly by mechanical means. In both cases, when the electrodes were returned to their cells, they failed to rectify, almost entirely, even after protracted formation. It would seem, therefore, that the action of the cell is not wholly chemical, but depends somewhat on the mechanical condition of the surface of the aluminium.

Ammonium phosphate and *ammonium bicarbonate* give off a strong odour of ammonia, particularly when the cell warms up.

The ammonia very quickly attacks any brass or copper connections attached to the electrodes or elsewhere, and is unpleasant to use. Nodon (Patent 5,978 of 1902) uses phosphate of ammonium either by itself or in the presence of phosphate of alumina and other salts. Siemens, in one of their patents, report that the addition of calcium or magnesium bicarbonate to the solution enhances rectifying properties at high temperatures. Nodon states that the current density should not be less than 1/10 ampere per cm.^{2}=1 ampere for 1.57 sq. in., and that the temperature should not be allowed to rise over about 30° C.

These ammonia salts do not throw down any bulky precipitate in comparison to sodium bicarbonate, potassium phosphate, and sodium phosphate.

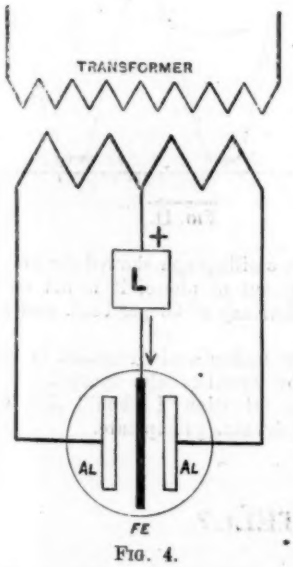

Fig. 4.

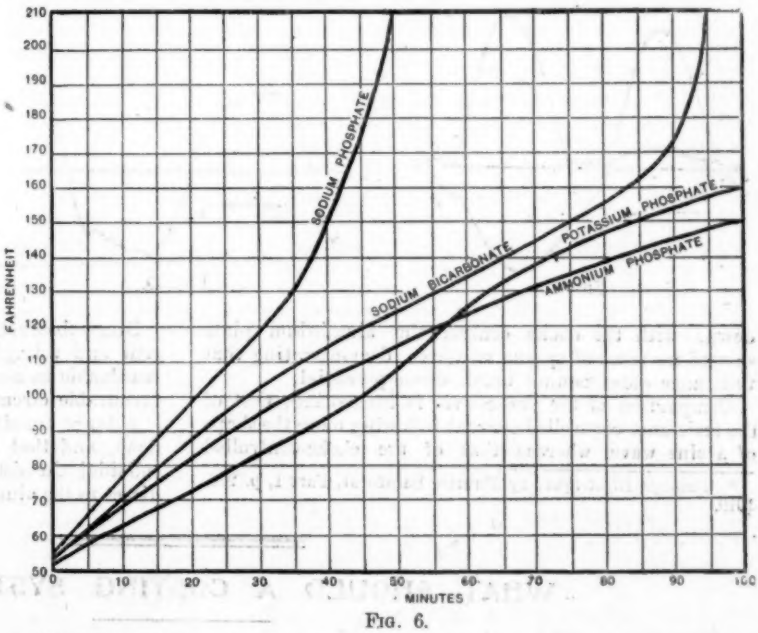

Fig. 6.

D

Sodium phosphate is not such an efficient salt as several of the others named; its precipitate is not so heavy or flocculent as that of sodium bicarbonate, but it has the quality of attacking the aluminium cathode rather badly in constant use.

De Faria* uses this electrolyte in his rectifier in the proportion of one part by weight of salt to eight parts of water.

Fig. 6 gives curves of temperature rise for four of the above-mentioned electrolytes. In comparing them, the voltage losses over the cell, as ascertained by the oscillograph, must be borne in mind, as well as their capabilities of rectification, conductivity, propensity to "snow up," action upon the electrodes, smell, and ease of handling; and last, from a commercial point of view—price.

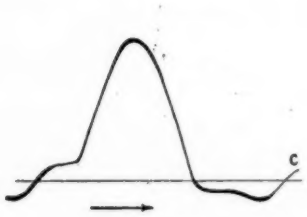

Fig. 7.

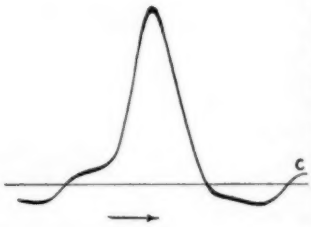

Fig. 8.

The oscillograms hitherto considered have been curves obtained from cells working on low voltages with a non-inductive resistance as load.

Fig. 7 shows a graph of a single cell working on the 200-volt mains with a non-inductive resistance as load, and fig. 8 the same cell with a choke coil in series with the load.

Whereas the voltage over the cell in the first case with resistance was 130 volts, with the choke in series the volts fell to 80. It was noticeable, too, that whereas with the resistance control the cathode was alive with small sparks, showing that the film of oxide was breaking down, with the choke control the aluminium plate showed no trace of sparks whatever, demonstrating that resistance alone cannot break down potential.

Comparison of the two curves is interesting, that of the resistance-controlled current following more the shape of a sine wave, whereas that of the choke-controlled curve is more peaked. The areas of the two curves, however, do not differ materially.

Fig. 9 shows the current and voltage curves over a cell arranged as in fig. 4, rectifying both pulses of the current. The voltage curve is superimposed on the current wave to which it belongs, the other half in the inverse direction being the voltage over that half of the transformer secondary which is idling. It will be noticed in several of these oscillograms that the current and voltage curves are not entirely in step, and that in figs. 9 and 11 the current hardly reaches zero. This is due to the capacity effect of the aluminium plates. Nodon states their capacity to be one microfarad per square centimetre, and undoubtedly they act as condensers of a high order.

The writer is inclined to think that when using both pulses of the wave, the rectifying power of cells is increased, since an alternate path being provided for the current (which would otherwise manifest itself as inverse), it takes this path rather than break down the film of oxide at the remaining pole.

Fig. 10 shows an oscillogram of the leakage current between the two aluminium plates. This current is largely wattless, but it has the effect of (*a*) warming up the electrolyte and (*b*) of tending to blow any safety fuses inserted in the circuit; another reason why the aluminium electrodes should be kept as small as possible compatible with reasonable current densities.

Fig. 11 is a graph showing the current and voltage curves of a 12-volt accumulator utilising both waves of the supply current.

The most noticeable point is the fluctuation of the voltage over the accumulator terminals. I understand that such pulsating currents applied to secondary cells are not disadvantageous, the continually applied pulses, with periods of rest intervening, stimulating the chemical changes which occur, even better than a continuous current of the same mean value would do.

With respect to the efficiency of these cells, an overall efficiency of 44 per cent. has been noted, this including losses in the cell and the transformer.

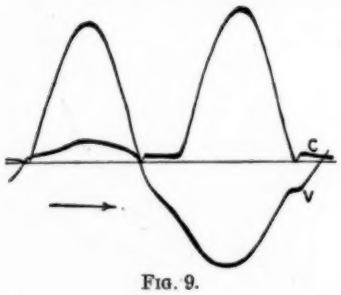

Fig. 9.

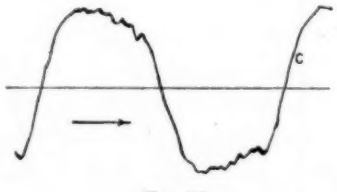

Fig. 10.

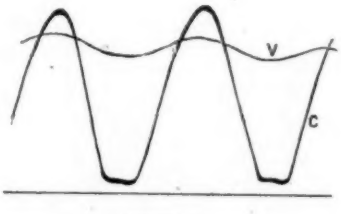

Fig. 11.

Since observation on the oscillograph showed the current and voltage decidedly out of phase, it is not unreasonable to assume an efficiency of 60 per cent. under favourable circumstances.

A large amount of work undoubtedly remains to be done, and that I think by chemists who specialise in colloidal chemistry, whose attention I should like to direct to the aluminium hydroxide precipitate.

* *Allumage Electrique*, by Maurice Sainturat, Part I, p. 236. 1910.

WHAT SHOULD A COSTING SYSTEM TELL?

By FREDERICK W. POPE.

The question of what a costing system should tell has been discussed innumerable times. It is raised here because of the hazy notions that still exist widespread.

Except in the case of those firms which have a very clear idea of what they want to know, the efficiency of a costing system depends entirely on the character of the works accountant who has charge of it. If he is easy-going, or fearful of the possible consequences of taking too strong a stand against the management, then this deplorable condition of things will be reflected in the system; if, while fully alive to the difficulties of running a workshop system and ready to co-operate as well as to advise, he sees that the essential principles of costing are not overlooked, then the perfect system (so far as the particular factory will allow) will be slowly evolved.

One of the misconceptions most frequently met with is that costing is estimating, or, at least, can be adapted to serve the double purpose of costing and estimating. Estimates are more reliable so far as they are based on cost records, but it cannot too often be pointed out that the estimating department is distinct from the cost department. Labour, material, and overhead expenses vary from time to time—especially in these days—and the estimator relying on the cost record of the product, has to bear these changes in mind.

In this connection the question of depreciation of stock value may be brought up. There is an idea held by some people that stock values may be written down in the stores ledger at any time, and frequently, during a financial year. Take the case of a factory where the cost records are quite distinct from the financial books (the general practice, the writer believes), how can any comparison be made between the profit shown in the balance-sheet and the total profit shown in the cost records, if prices have been altered in the stores ledger? The writing down of stock values is, unfortunately, a very necessary thing in these days, but if, at the end of the year, you wish to check the accuracy of your system, your object will be defeated—unless you have kept very accurate records of any alterations. In the writer's opinion, the correct price is that at which the various items were taken into stock. This price remains until a new consignment (purchased during the current year) comes into use. The question is one of many which might be reviewed by engineers and works accountants jointly; it is one which is bound to arise where there is confusion between costing and estimating.

What should a costing system tell? The manufacturer has first to make up his mind what he wants to know: methods cannot be decided upon until he has taken this first step. He is, say, a manufacturer of electric motors, and the chief thing in his mind will be: that he must get the cost of any and every machine he is turning out, and that he must make comparisons with previous machines of the same size. The various parts have been machined in sets; what have they cost? Is there any variation from previous costs, and why? The building of cores, the winding and assembling of motors must be treated in the same way.

Later on he will begin to take an interest in the monthly value of output, and compare again. The work done in various departments, and whether it is done in the best and cheapest way, will provide another field for investigation. As was said in a previous article, "the secret of efficient costing is analysis."

To the many problems of costing, a solution will only be found when some effort is made towards standardisation of costing methods. The Institute of Cost and Works Accountants, the employers' associations, and the technical societies represent the "big three" in this important matter, and if, in the meantime, they do no more than lay the essential foundations of a standard costing system, the benefit to manufacturers will be immediate, and the way will be made for further investigation.

ELECTRICAL PROGRESS IN PERU.

Developments Leading to Demand for Electrical Machinery, Plant and Equipment.

By PERCY F. MARTIN, F.R.G.S.

With the aid of foreign capital, drawn partly from the United States, Canada, and Italy, a boldly-conceived scheme of electrical construction has been decided upon in Peru. The amount of capital involved, as a commencement, exceeds L4,000,000; but it is expected that before the whole of the projects are carried to consummation three times that sum will have been expended in the country upon construction work, new machinery, plant, fittings, and accessories.

The two principal enterprises are those connected with what is known as the Dunsmuir concession, comprising electrically-operated railways, waterworks, and electric-light stations; and the contract of the Emprésas Electricas Asociádas for the rehabilitation of the Lima electric light and street-railway systems. In connection with the last-named undertaking, Italian capital to the extent of L1,000,000 will be invested, the management of the company being Italian. Here one may expect that a large part of the equipment will also be of Italian origin.

But so far as the Canadian part of the above named plans is concerned, opportunities for British manufacturers of electrical plant will be provided. In many respects the Dunsmuir concession is the more important, comprising as it does a great deal of construction and installation extending over a number of years.

Apart, however, from these large enterprises, Peru offers a favourable market for electrical goods. Abundant water-power is available in almost any part of the country, while the laws governing concessions for its use are extremely liberal. On the western slope are found numerous streams; true, they are mostly small, and in dry seasons dwindle considerably; but modern engineering knows how to provide against complete dryness, and, by the construction of dams at suitable spots, cause the streams to supply a fairly abundant power throughout the year. In numerous cases storage reservoirs can easily be installed on the watercourses; but to-day large quantities of water are allowed to run into the stream during the rainy season—completely to waste. On the eastern slope there are steep descents, and, in addition, plenty of water flows from the snow-capped mountains or from the plentiful rains that fall at all times during the year. It is in this section of the country that the large developments of the future will take place.

Hitherto there has been little opportunity to develop sites on a large scale, because there has been no market for the current; but with the introduction of the enterprises above referred to the possibilities are almost unlimited, especially when mining and industrial enterprises requiring power are taken into consideration. All the larger Peruvian towns possess electric-light plants. But the installations are not large in comparison with those of other South American States. In Peru to-day in all probability the whole of the generators have a total capacity of little more than between 40,000 and 45,000 kW, distributed as follows: In the mines, 25,000 kW; in the larger cities, Lima, Arequipa and Cuzco, 14,500 kW; and in all the rest of the country, 3,000 to 4,000 kW. The electricity at the mines is used almost entirely for power, only a small part of it being available for the use of individuals who might be regarded as possible purchasers for current-consuming devices. The smaller plants scattered throughout the country can only be reached through the medium of dealers in Lima, the capital; these, in turn, sell to the small dealer or to the consumer direct.

So far, the market for electrical supplies has been confined practically to the three cities mentioned; but in view of the concessions referred to above the scope will be widely extended, and a large portion of the population hitherto deprived of the facilities afforded by electrical installations will be benefited. With the introduction of new methods and devices, a wider development of the electrical industries may be looked for. Even as things are to-day, however, such cities as Lima and Arequipa offer an opportunity for the sale of small electrical devices. The customers of the Lima Light,

Power and Tramway Company rose from under 11,000 at the end of 1916 to nearly 16,000 at the beginning of 1922.

The principal markets for electrical manufactures are to be found in house lighting, shop and window lighting, electrical signs, municipal lighting and farms (*haciendas*), and lighting and power in the agricultural districts; many of these already have small sets, but hundreds are still without them. There is ample reason to believe that, if approached with attractive offers, 50 per cent. of the *haciendas* unsupplied would be willing to introduce small plants for lighting the buildings. There are also many small towns as yet unprovided with electricity which would no doubt be willing to enter into contracts for the establishment and equipment of central stations and transmission lines. Where electricity has been installed, there would arise a steady demand for such equipment as lamps, wire and wiring devices. A substantial trade may also be carried on with the larger mining districts of Huancayo, Oroya, Casapalca and Junin, where hydro-electric plants are already installed. Although the managements are mainly American, there is no prejudice against British manufactures, and, indeed, several British sets are in use. It may also be of interest to note that at Junin some new vanadium mines are to be shortly opened, in connection with which enterprise a large electrical plant is contemplated. Other stations are being contemplated in Peru, which may be regarded as one of the more promising of the South American markets at the present time.

HINTS ON RUNNING AN ENGINEERING "SHOP."

(Communicated.)

During recent years a large number of small engineering works have been opened. In many cases the proprietors are working engineers who have never had the opportunity of obtaining training in modern business methods. The need of a satisfactory system of organisation for their business is often felt by these firms, but usually the engineer-owner does not know where to start, or the principles upon which his business should be based. The following hints, therefore, may prove helpful to readers of this journal.

Every order received should *immediately* be entered in the "Orders Received" book, and the order should be known by this number right through the works. The following ruling is useful:—

J.O. No.	Date.	Name of Customer.	Description.	Order No.

When instructions have been issued to the works to proceed with an order, the workman should enter on the daily time sheet the number of hours worked on each job; in every case using the number allocated to the job in the orders received book. The time sheet system can be varied according to the nature of the business; in some cases, a weekly time sheet is better than a daily one.

When materials are required from the stores, a "Requisition Form" should be made out and signed by the foreman. Every morning these forms for the previous day should be sent from the stores to the office, where the various prices should be filled in and entered upon the respective cost sheet. The job order number should be put on the requisition form, and this number should correspond with the cost sheet to which the amount expended on materials is posted.

Similarly, the total number of hours worked on each job should be transferred from the time sheet to the cost sheet. To the total obtained should be added a certain percentage for "non-productive" wages paid, and thus the prime cost of each job can be ascertained. To this should be added a percentage for the overhead expenses of the factory (*e.g.*, rent, rates and taxes, lighting, insurance, &c.) and then the estimated percentage for profit.

All invoices sent out should be typewritten. It is a good plan to have the invoices numbered and made up into pads. As each invoice is made out, a carbon copy can be taken, and from this can be entered the day book, or, alternatively, it is possible to post direct to the ledger, and simply make out a summary invoice sheet showing the total invoiced for the month.

For invoices received, the following method will be found satisfactory. The advice notes should be checked against the goods as soon as they are delivered; if everything is in order, the advice note is initialled by the storekeeper, and passed through to the office. The invoice can be compared with this, the extensions checked, and the name of the supplier, particulars of goods, and the total amount entered in the purchase journal. Every month the purchases should be analysed, and the various totals posted to their respective accounts in the "Impersonal" ledger. If materials are bought for work outside the "shop," the total of the invoice received can be entered direct on to the cost sheet, and if, later on, any materials are returned to the works from the job, these materials can be *credited* on the cost sheet.

At the end of every week there are the usual wages to be paid. The rates of labour, number of hours worked, name of workman, fares spent (less insurance due) should be entered in this book. The following ruling has been found efficient:—

WAGES. Week ending.....

Hours.	Name.	Rate.	Wages.	Fares.	Total.	Insce.	Total Paid.

The number of hours worked can be obtained from the time sheets, and these sheets should be compared daily with the time book showing the time of workmen's arrival and departure. The total of the wages book should agree with the labour on the cost sheet, plus any time worked not booked on jobs.

Correspondence should always be attended to the first thing every morning. Any quotations should be dispatched immediately (if this is possible), and a careful record should be kept of these. If no reply is received within a reasonable time, it is well to call upon the prospective customer and find out if any further assistance can be rendered. All orders should be acknowledged the same day as received, and queries and complaints dealt with forthwith.

It is essential that periodically a Trading account, profit and loss account, and Balance sheet be drawn up. For this purpose, it is necessary to take stock. The "work-in-progress" must also be included, and as these two items bear an important influence on the balance sheet, great care must be exercised to verify the accuracy of the figures obtained.

Depreciation, goodwill, plant and machinery are subjects too vast to enter into here, but it is well to study these matters carefully, in order that the financial position of the firm may be correctly ascertained at any time.

THE MID-LANCASHIRE ELECTRICITY DISTRICT.

ELECTRICITY COMMISSIONERS' INQUIRY.

As briefly reported in last week's issue, the inquiry into the proposals submitted by the Corporations of Blackburn and Preston jointly and by the North-East Lancashire Electricity Committee for the improvement of the existing organisation for the supply of electricity in the Mid-Lancashire District, was opened at the Preston Town Hall on February 20th. It was continued during the week, and came to an end on Monday last. The Commissioners were Sir John Snell (chairman), Sir Harry Haward and Mr. W. W. Lackie, accompanied by Mr. E. W. Hudson, legal adviser, and Mr. S. Cumberledge, clerk to the Commissioners. Mr. T. Rowland Harker appeared for the Corporations of Blackburn and Preston, instructed by Mr. Lewis Beard, Town Clerk of Blackburn, and Mr. Alfred Howarth, Town Clerk of Preston; Mr. W. E. Tyldesley Jones, K.C., and Mr. T. B. Leigh, instructed by Mr. J. D. Ritchie, Town Clerk of Burnley, and hon. secretary of the North-East Lancashire Committee, appeared for the Corporations of Burnley, Blackpool, Accrington, Colne, Darwen, Rawtenstall, Bacup and Haslingden, and the Urban Districts of Brierfield and Fleetwood; Mr. Craig Henderson, K.C., appeared for the Lancashire Electric Power Co.; Mr. A. Tylor for the London, Midland & Scottish Railway Co.; and Mr. H. W. Cleaver for the Lancashire County Council; Mr. W. Elkington represented Leyland Motors, Ltd.

In his opening statement, Mr. Rowland Harker said there were fundamental differences in the two schemes that had been put forward. Two areas widely different in character had to be considered. To the westward of Preston was a district of a residential character, including the coast towns of Fleetwood, St. Annes and Blackpool. The other area, stretching from Preston to Colne in the north-east, and to Rawtenstall in the south-east, included districts that were undeveloped industrially and were of an agricultural nature, but in the main it was an industrial area, and a most important centre of the cotton industry. There was a number of engineering works of considerable size, and a few coal mines. So far as the cotton industry was concerned, experienced men in the trade differed widely in their views as to the use which could be made of electrical energy quite apart from the question of cost. In Blackburn and Preston there were men who anticipated a very great future for electrical development in the cotton industry, but he believed in the neighbourhood of Burnley a contrary view was taken. He believed some of the opposition to the Blackburn and Preston scheme was due to the difference of opinion.

Mr. Tyldesley Jones said no evidence need be called to prove that, apart from cost, electricity was suitable for the cotton industry.

Mr. Harker said the actual experience at Blackburn was that since October, 1921, when a station started running, ten mills had come on and eleven had applied and were waiting to be connected. There were 120 other mills in Blackburn alone, which indicated the enormous possibilities. No definite information had been obtained from the Railway Co. as to any proposals for electrification of the lines in the district, but the line from Blackburn and Burnley to Blackpool would eminently lend itself to that. There were few such important districts in England which until quite recently were so badly off in respect of the supply of electricity. The Burnley scheme left Preston in a state of splendid isolation. His clients' idea was that the undertakers owning the stations should continue to supply consumers within their own limits, and sell any surplus to the Joint Authority for distribution in bulk to others who might require it. By 1931 the three large stations would be in full commission, a complete system of transmission lines would be working, and the uneconomical stations would be shut down. It was estimated that by 1931 there would be 85 million units available for purchase and distribution by the Authority.

Mr. Henry Astley Bell, Chairman of the Electricity Committee of the Preston Corporation, examined by Mr. Rowland Harker, said that his Corporation left the inclusion of Clitheroe, Preesall and Garstang in the proposed district entirely to the Commissioners. It agreed to the Blackburn station being connected with the Preston station with a duplicate main, the cost of which was estimated at £138,000. The Corporation recently acquired the undertaking of a company in Preston. At the moment, however, the available supply was entirely inadequate. People who intended to electrify their plant, but who were not able to secure the supply they desired, had put in new steam plant, and applications for domestic supplies had also been turned down. The station which was situate on the River Ribble was sanctioned in 1921, and would probably be in commission some time in 1924. They were confident that it would start with a load of 8,000 kW, practically 5,000 in excess of the present supply. That figure represented the demand for power. Lighting, heating and domestic purposes had been left entirely out of account in making the calculation. On the route of the transmission main between Preston and Blackburn there was a number of places of some importance which could be connected up to the line. To the west of the town, with the exception of two or three cotton mills, there was nothing which would take power in bulk. Between Preston and Blackburn, however, there was a large number of cotton mills. In reply to the Chairman, the witness said the connection from Blackburn to Preston was immediately necessary in order to relieve the Corporation, even when the new station was in commission. The expenditure of £138,000 would obviate an outlay which would otherwise have to be incurred upon spare plant in those two stations, and would bring revenue to the two towns from the industrial districts close to. His Corporation was definitely of the opinion that the existing generating stations should remain in the hands of the people who erected them. In the scheme provision was made for the ultimate expansion of the Preston station to 50,000 kW, and when the necessity arose it would be enlarged by the Corporation at its own expense.

On Wednesday, Mr. Harker said that on the question as to what control, if any, was to be given to the Joint Electricity Authority of the generating stations, his clients thought it would be right and proper for a clause to be inserted on the lines of Clause 33 of the Draft London Order, which provided that any two or more authorised undertakers might enter into an arrangement with regard to the joint working of their stations, but in negotiating and considering such an arrangement they must consult the Joint Electricity Authority. If the two parties could not agree, their views would have to be submitted to the Commissioners.

Mr. Henry Astley Bell said his Corporation was anxious to see a Joint Electricity Authority set up, because they were going to deal with considerable areas of undeveloped country, and he understood that the Joint Electricity Authority was the only authority that would have power to enter those areas and lay the necessary mains to secure a supply of electricity, whereas an Advisory Board would be able to do nothing but advise. In answer to Sir Harry Haward, the witness said that the Preston Corporation was quite new to the electricity business. The present expenditure on capital account was about £300,000, and related mainly, if not entirely, to the purchase of the National Electrical Supply Co.'s undertaking. Assuming that the commitments in connection with the new station on the Ribble reached an approximate figure of £420,000, it would bring its commitments to £720,000.

Sir Harry Haward: Would the Preston Corporation be prepared to face a capital expenditure on its electricity undertaking of £1,170,000?—We have always had the figure of 40,000 or 50,000 kW in our mind, and were always prepared to see it through, but there is no definite resolution binding this Corporation to that. In any case, it would proceed by very easy stages, and that capital expenditure would not be incurred unless a strong convincing case were made out that it would be required.

Councillor Henry Russell Hornby, Chairman of the Blackburn Electricity Committee, said the cotton mills in his district now using electrical power had a consumption of 7,118 h.p., and those for which applications had been received represented 6,068 b.h.p. In addition, there were about 580 applications for ordinary domestic supply. His Corporation came to the same conclusion as Preston on the subject of the transfer of the generating station to a Joint Electricity Authority, and it regarded as an essential feature of any technical scheme the linking up of Blackburn and Preston and the extension of the latter station to its economic capacity. Cross-examined by Mr. Craig Henderson, he agreed that Blackburn had no desire to interfere with the local rights and powers of the Lancashire Power Co. in the area.

Mr. William Birtwistle, cotton mill proprietor, who has a controlling interest in a number of manufacturing concerns in Lancashire, including Preston, Blackburn, Darwen, Haslingden, Great Harwood, and Withnell, said he had adopted electrical power in many of his concerns. Variation in speed was one of the difficulties in the process of spinning; the highest point of the variation was where the worst yarn was produced. His experience was that with the electrical drive they got a higher speed without variation and a better yarn than with steam drive. They were getting in 48 hours very nearly the output previously got from steam-driven plant in 55½ hours. He thought they could still get a little higher. Another advantage, so far as the workpeople were concerned, was its cleanliness. Moreover, as they were paid according to output, their wages were improved. Probably the electric drive was less liable to accident than steam.

Mr. George Birkett Williamson, chief engineer to the Amalgamated Cotton Mills Trust, was authorised by the North Lancashire Cotton Masters' Association to give evidence. Under his control as engineer he had 38 separate sets of power plant, totalling altogether 37,500 h.p. and 28,000 kW, of which 6,800 kW was at present in use. Of that quantity, 2,250 kW

was supplied by public supply authorities, and the remaining 4,300 kW came from plant laid down by individual manufacturers. He thought the working cost, the price paid for the energy consumed, was rather higher for electricity than with an up-to-date steam plant. In the matter of initial capital costs and installations, with the usual group drive, that was with large motors, the first cost was less than with a good steam plant, but where there was a great sub-division of the power with small motors, the first cost might be, and usually was, higher than with a steam plant. The advantage of electricity over steam, from the point of view of the arrangement of the machinery in the mills, was that the separate machines could be arranged without any regard whatever to the shafting or prime mover, and the machines could be arranged to the best advantage, from an operating point of view, independent altogether of the power plant.

Mr. James Archibald Robertson, consulting engineer, Manchester, gave details of the proposed scheme. The district was in need of increased supplies, and was one of the areas that proved the need for a co-ordinating authority to a greater extent than any other district in England. In South-East Lancashire the cotton industry was adopting electricity on a very large scale, Bolton having some 23,000 h.p. in the textile trade, Manchester 22,000 h.p., and the Lancashire Power Co., covering a number of the smaller in South-East Lancashire, had 33,000 h.p. of textile load on its lines.

(To be continued.)

The Blackburn and Preston scheme was drawn up by Mr. J. A. Robertson, while the alternative involving an Advisory Board was prepared jointly by Mr. Blackmore and Mr. C. L. E. Stewart, borough electrical engineer and tramway manager at Rawtenstall. On the fourth day of the inquiry it transpired that the latter scheme was so strong that witnesses were not called, and the Blackburn and Preston authorities came to terms, the scheme being submitted as an agreed scheme, limited to 1926, with an estimated total capital expenditure of £843,000.

The following generating stations will continue to be used: Accrington, Blackburn (Whitebirk), Blackpool, Burnley, Colne, Darwen, Fleetwood, Nelson, Preston (Ribble), Rawtenstall, and St. Annes. When required, a new generating station will be erected at Padiham by either the Burnley Corporation or the Lancashire Power Co.

The generating stations to be closed down are those at Bispham, Blackburn (Jubilee Street), and Blackpool and Fleetwood (tramway).

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Placing of Contracts by Public Bodies.

I have read with interest Mr. C. W. Crosbie's letter on the "Placing of Contracts by Public Bodies," and would state that were conditions normal or similar in the countries we are in competition with, the remarks made would be perfectly correct.

The reason the present position is totally different and rendered extremely difficult is because:—

First, our rate of taxation is enormously higher than that of our chief competitors.

Secondly, our rate of wages is much in excess of that of our chief competitors.

We are to-day the highest-taxed country in the world. This taxation has enabled us to balance our Budget, pay our way, and so bring the pound sterling nearly to normal.

Our chief competitor has not attempted to balance her Budget, but is to-day subsidising her railways, post, coal, and bread stuff, consequently her taxation is comparatively light; the wages paid to workers are a mere fraction of what is being paid in this country.

If we were to-day to act on the suggestions made by the writer of the letter in question, the number of unemployed would still further increase, the cost of employment relief would also increase, a number of works would have to close down further departments, and our rate of taxation would be much heavier.

There is a remark in the letter in question which states that "it would be better if the town which requires its plant would apply the difference in cost between British and foreign plant in more profitable local employment, or in the last resort to the alleviation of its own distress." I should like to know what more profitable employment can be given than employing workmen on the skilled work which they are in the habit of doing, rather than giving it in the way of doles, which in time lessens the desire for work and has a tendency to make the workman lose his skill.

The very fact of a number of large manufacturers to-day making only from 40 to 60 per cent. of their production is sufficient proof of the increased cost of the goods or of the unprofitable nature of the work. If the manufacturers could get back to nearly their full production it would enable them to work profitably by proportionately reducing their overhead charges, and the only way to enable the manufacturers to do this is by their being able to procure sufficient work to employ the full number of hands.

Even Belgium, France, and Italy are not as yet fully taxing their population, neither have they balanced their Budgets, consequently many of the manufacturers in those countries are being subsidised to the extent of being much less heavily taxed than we are, and consequently having overhead charges much lower than ours. Were those countries taxed proportionately to the revenue requirements, to enable them to balance their Budgets, their prices would be considerably higher than they are to-day.

Albert A. Goldstone.

Manchester, *February 22nd*, 1923.

The writer desires at the outset to express his regrets and to apologise for an error, which escaped his notice, having reference to the cost of energy in respect of the copper losses which were stated to have been computed at 20 per cent. load factor, whereas the figures given represented the cost at 100 per cent. load factor. Making the necessary adjustment in this respect, the difference in present value would stand at £542.

Turning now to the points raised in Mr. Austen Stigant's letter, the writer has handled a good many quotations for transformers, and cannot recollect ever having had definite tolerances put forward voluntarily by British firms, the practice evidently being not to do so unless the contract is subject to a penalty and bonus clause, and, consequently, he assumed a figure which would represent more nearly the position in a case where one firm would submit to a penalty without the corresponding obligation of a bonus and another which would not accept such terms.

With regard to the question of price, the figure of £260 was taken from a recent number of the Electrical Review announcing the placing of a contract, and therefore the £200 stated by Mr. Stigant would appear to be either too low or the quality and performance of the transformer are not comparable with those of the £260 transformer, or otherwise his firm might have been successful in securing the contract which went to another firm.

The writer's varied experience both as a salesman and purchaser, at home and abroad, his intimate knowledge of the operation of British and foreign plant and his connection for a number of years with two British electrical firms of the highest reputation enable him to take a broader and less prejudiced view of the relative merits of British and foreign machinery than would have been the case had his experience been limited to a solitary firm and to this country alone. Consequently, he is unable in general and unqualified terms to concede superiority to British plant, of which Mr. Austen Stigant is so absolutely convinced.

Engineers who are conversant with facts and practice in the art of their profession recognise that there are Continental firms whose standard of excellence is quite the equal of that of any British firm, and here reference need only be made to two out of many, Tosi and Sulzer. In Mr. Stigant's own branch the writer could name at least one Continental firm whose achievements, in the matter of the size of single units, output, and voltage, are as yet unequalled by British firms, with the exception of one at present engaged in the construction of an exceptionally large transformer. The writer can hardly be singled out for his ignorance of facts when a recognised authority on h.p. transmission and distribution has recently had occasion to write to this journal inquiring whether any transformers had been manufactured in this country complying with certain particulars indicated by him. One manufacturer replied giving a few isolated examples—a drop in the ocean of Continental experience.

As regard fallacious reasoning and arguments, the writer is content to leave that to the judgment of others, only remarking that he is doubtful whether Mr. Stigant would, in the conduct of his own personal affairs, put into practice the principle he enunciates—*i.e.*, of making a free gift of not less than 45 per cent. (his own figures) of the value of every purchase he makes; further, he would probably have been better advised, in his sweeping condemnation of foreign manufactures, had he reflected that his own firm, in common with others in this country, purchase from abroad a very important and essential component of their products, upon which they depend to a very large extent for the reliability and success of their apparatus.

C. W. Crosbie.

Bedford, *February 26th*, 1923.

I desire to reply to the letter in your issue of February 16th, headed "The Placing of Contracts by Public Bodies."

It is with some regret that I read in an electrical trade journal a suggestion that electrical plant should be purchased from abroad because it is cheaper, in order to enable the manufacturers of other trades to export their goods. This policy is recommended by your correspondent as "the only

sane policy," and one is led to believe, either that he is one of the manufacturers desiring to benefit by the importation of cheap electrical machinery, or alternatively, that he is the representative of a foreign manufacturer of transformers.

It is regrettable also to read that patriotism is a "catch phrase." One knows it to be something very much better.

My principal reason for commenting on the letter is the basis of comparison upon which your correspondent calculates the financial benefits of the purchase of foreign transformers. There are many factors which could be criticised, notably that the capital cost of a British transformer of 200 kVA is more likely to be £200 than £260 as stated, &c., &c., but my main point of criticism is that the British firms are alleged to take full advantage of the tolerance of the guaranteed efficiency. Your correspondent's knowledge of foreign transformers probably justifies him in assuming that foreign firms deliberately calculate so that full advantage is taken of what is intended to be—as its name implies—a "tolerance." I do not think he has any ligitimate reason for supposing that British manufacturers do so. As a fact, it is very seldom that a British manufacturer uses the tolerance.

It can be shown that with a guaranteed efficiency of 98 per cent. on a 200-kVA transformer, with the British manufacturer living up to his contract and the foreign manufacturer taking advantage of the .2 per cent. tolerance, the British offer is 14s. 10d. higher than that of the foreign manufacturer, even if the foreign price is 20 per cent. lower than that of the British one.

Dealing with the last paragraph of the letter, one wishes that the writer would follow his own advice and "allow trade to take its natural course." The natural course seems to be, at present, the instinctive wisdom of giving work to one's fellow-countrymen rather than unemployment doles.

R. H. Schofield.

Hollinwood, *February 28th*, 1923.

Theft of Electricity.

We find published in your issue of January 19th, a letter from Mr. Preston with reference to the theft of electricity and its prevention. Mr. Preston bemoans the fact that no manufacturer has yet put on the market a meter and fuse unit mounted in the same case so as to prevent consumers from tampering with the meter. As it happens, we have recently brought out a meter-protecting cover which we think exactly meets Mr. Preston's requirements.

The mounting consists of three metal strips welded together in the form of an "H." The meter is hung by means of a stud on the middle limb of the mounting, and is secured by two screws tapped into the lower crossbar. The fuses are mounted on the upper crossbar above the meter. The mounting is attached to the wall by means of four screws passing through the upper and lower crossbars. The cover fits closely over the meter, and is attached to the mounting by four ordinary cover-fixing nuts. Apertures are provided above the meters to facilitate inspection of the fuses.

We believe this arrangement answers all Mr. Preston's requirements and meets the needs of those engineers who want to give the meter adequate protection against any possibility of being tampered with.

Landis & Gyr, Ltd.
Llew. R. Lester.

Hampton Hill, *February 26th*, 1923.

Arc Welding.

I should like to add a few remarks on the above subject to those which have already appeared in the Electrical Review.

With reference to the letter in the issue of the 9th inst., it may be stated that the a.c. arc is an example of "unidirectional" or continuous conduction, and on this depends the use of the arc, in another branch of electrical engineering, for rectifying alternating voltages. The condition which Mr. Langdon-Davies calls "continuity" in his letter is due to the slight conduction which takes place through the residual vapour between the electrodes, and thus, when the voltage is not sufficient to "strike" an arc, this vapour conduction carries the current. The power factor of the arc is *not* due to the regulating devices in the circuit; the power factor of an arc, when the carbon is soft and the arc is steady, is near unity. When the carbon is hard and the arc unsteady, the power factor falls, and in extreme cases becomes as low as 0.6. This is also the case, but in a greater degree, with metallic electrodes.

Regarding the letter from Mr. Gilbert, in the current issue of the Review, I fail entirely to understand the remark that "the carbon electrode cannot be used with a.c." I was certainly under the impression that the carbon welding arc could be used as easily and well with a.c. as with d.c.; in addition to this the a.c. carbon arc has several advantages over the metallic welding arc on a.c.

First, in general the a.c. carbon arc is more stable than the a.c. metallic arc, and can, therefore, be used with greater ease. Secondly, due to the lower resistance of the residual vapour immediately after the passage of the arc voltage peaks are found. In the case of metallic arcs these peaks are very high and sharp, and frequently reach values of several thousands of volts, and are thus dangerous to life, although this is not indicated on a voltmeter connected across the circuit. With carbon arcs, on the other hand, these peaks are lower and rounded off, and the softer the carbon the greater is the latter effect. It will, therefore, be seen that the carbon arc on a.c. is far less dangerous than the corresponding metallic arc. Thirdly, the carbon arc has a greater length than the corresponding metallic arc, and is therefore easier to manipulate.

Further, among welders of wide experience it is found that for many purposes the asbestos-covered electrode is preferable to the flux-covered electrode, *provided it is correctly used*, but of course, this condition governs all welding.

T. W. J. Powell.

Barrow-in-Furness, *February 24th*, 1923.

In reply to the article on "Welding," by Mr. W. Langdon-Davies, having had a wide experience of electric welding of all classes, using a.c. and d.c., I find that operators prefer d.c., positive to the job (earth) in most classes of work, negative (earth) in some cases of cast-iron welds, using electrodes coated with a cheap flux (as supplied by Robinson and Hands Electrical Co., Ltd.) in preference to covered electrodes, and thereby obviating a hard black slag forming in the weld.

A. Fisher.

Lincoln, *February 26th*, 1923.

Electrical Engineers' Remuneration.

Are electrical engineers deteriorating in value? The writer thinks so, in view of the fact that many unskilled men are receiving better remuneration. There is no trade or business wherein more knowledge and skill are required than that of electrical engineering; still the electrical engineer is seemingly not worth very much in these days. Why did we serve an apprenticeship? Why did we educate ourselves in the technicalities of our business? We did those things for the doubtful satisfaction of earning a salary equal to that of a policeman or a bacon curer. Some people say: consider the satisfaction one has of knowing that one possesses skill and technical knowledge of one's business. To me that is just so much "piffle," as most people do not educate themselves merely for the purpose of knowing that they have been educated, but do so in the hope of their education being of financial value at a later date. The writer is not a B.Sc. nor an M.I.E.E., but has worked and studied hard for many years. Now that ability has been proved, he is not a little disappointed to be receiving a miserable salary of approximately £200 per annum. I have endeavoured to improve on the figure mentioned by answering many advertisments in your esteemed journal, only to be disgusted by offers of a salary a good deal less than the above-mentioned amount. This is the sort of thing that makes one say: "Why did I trouble to serve an apprenticeship?"

Electrical Engineer.

February 15th, 1923.

Therms and Kelvins.

It is a little surprising that no notice has been taken of an error in the speech of Dr. Carpenter to the shareholders of the South Metropolitan Gas Co. on the 15th inst. The extract is from *The Times*:—

Definition of the Therm.

"Now, the unit of measure proposed was much simpler than that already in universal use for the measurement of electric energy. This latter is based upon the deposition of silver from a certain salt of that metal, *and has no other association with the great bulk of the uses to which that form of energy is put*. The fuel Research Board took as its standard the British thermal unit, used for over a century as a basis of calorific measurements in this country, and, in order to make it manageable as regards size, grouped one hundred thousand of such units under the expression of 'therm.'

"Now, a British thermal unit was defined to be the amount of heat absorbed in raising one pound of water one degree Fahrenheit. Hence the definition of a therm is the amount of heat required to raise 100,000 lb. (or 10,000 gallons, which is the same thing) of water one degree Fahrenheit in temperature."

Surely Dr. Carpenter knows that the silver voltameter is *not* in universal use, and is merely a final standard of reference; that the Kelvin or "unit" is the actual unit by which we are metered and pay; and that a Kelvin is definitely 3,440 British thermal units or (say) one thirty-third of a therm, some 80 per cent. of which is actually recoverable in an electric kettle. One would have expected some of our publicity organisations to have pinned this erroneous statement down at once.

J. W. Meares.

Guildford, *February 24th*, 1923.

The E.P.E.A. and Halifax Corporation.

With reference to the above dispute and your advertisement in this week's issue of the Electrical Review, I should like to make a few comments. You, Mr. Editor, are evidently fully aware of this dispute, because you have an article about it on p. 294, and from the nature of the advertisement you must also know that this unscrupulous Corporation has dismissed the whole of its technical staff, because it wishes to treat an agreement as a "scrap of paper" only. Now, sir, my point is this, that when the medical profession has a dispute with a Corporation the medical papers refuse advertisements from that Corporation, and I maintain that this should have been your course of action.

Many of our members have always thought that your paper was an employers' paper, and this advertisement certainly points to that assumption. My advice to all E.P.E.A. members is in future to leave your paper severely alone.

E.P.E.A. Member.

Barrow-in-Furness, *February 25th*, 1923.

Watt-hour Meters for A.C. Consumers.

Mr. North's letter on this subject was probably interesting to many of your readers besides myself. My problem is in connection with small electricity undertakings where for various reasons a.c. must be employed, and the single-phase system, on account of its superiority as regards low cost of installation and simplicity of operation. We are intending to use kVA-hour meters for power circuits, pointing out to the consumer that he *can* obtain efficient motors by paying a little more for them. It is thus up to the consumer to use high-p.f. motors, and he is more likely to watch his power-factor than if it does not matter to him.

The notoriously bad starting of the a.c. ampere-hour meter does not matter, because the starting current of the motor is considerable, and the meter does not have very low currents to register. I find I can get the instrument I want from several sources.

There is one point on which I join issue with Mr. North, and that is where he says a charge based on the reading of the ampere-hour meter would be high and illegitimate—but surely it is common practice now to charge per kVA and not per kW of maximum demand, and I do not see much difference between doing this and charging for ampere-hours.

As to the lighting consumer, it is intended to use watt-meters, because if fans and domestic motors are used at lighting rates, the undertaking can afford to ignore the low p.f.

A. Hugh Seabrook.

London, *February 26th*, 1923.

The Sale of Wireless Apparatus.

I note in reference to your leading article respecting the above that it does not appear to have drawn very much correspondence on the subject, which will, no doubt, cause you to think that the electrical contractor as a rule is apathetic, or, in other words, bears out exactly what you said about him.

I am not of the opinion that this is actually the case as, to take my own case, I have tried very hard to bring the matter down to something like a business footing, that is, to obtain from the different manufacturers of wireless apparatus actually what certain sets were valued at to sell, and I have given specifications of different kinds for the purpose of obtaining proper prices on this footing.

So far, after about six weeks, I have only found one firm that offers an apparatus on a business-like footing. The replies received from the rest are so obscure that it is difficult to tell what they are offering.

I have also ordered sets of apparatus from two different firms, and from the position of the town where I carry on business, naturally they must be of an expensive type, so our sale is not really expected to be very large; but I regret that in both cases, although orders were stated to be delivered from stock, a month has gone by and so far nothing has been delivered to me, so that I am afraid that the push I have made for the sake of selling these has rather been wasted.

Your Manchester correspondent's remarks were quite in order, although I note you seemed to think his meaning was rather obscure. I consider his strongest point was the remark that motor-car dealers could buy any of these articles at the same price as an electrical contractor; and in fact, it might be carried further, as all motor-car dealers can buy *everything* in the electrical line at the same trade price as we can; but in strange contradiction to this, neither your correspondent, nor anyone else in connection with the electrical trade, can buy a motor-car at trade price.

I mention this with envy of the organisation of the motor trade, but if it is such a closed corporation as apparently it is, why is it that it should be able to buy *our* goods at the trade price?

You can understand the pitch this has reached when I tell you that on more than one occasion, when ordering motor-car lighting sets, I have had a reply from the suppliers to ask me whether I am a member of the Motor Traders' Association, otherwise they could not supply me.

I think that anyone connected with the electrical trade will appreciate how nice this is—to think that you cannot buy a purely electrical article at trade price, whereas a man who is not an electrical engineer can buy, not only this article, but any electrical goods at trade prices.

These remarks bring me back to the question why a garage or anyone except an electrical engineer exclusively trading as such should be allowed the trade price for wireless sets, as it must be quite evident to anyone that these are sold by *every* trade, and not only motor-car dealers.

There is, however, *one* wholesale firm in our trade which is not allowing trade discount to anyone except electrical contractors; but it is not a very satisfactory idea to think that you are, and have been for a great many years, in a business that is considered to require technical knowledge, and at the same time be expected to sell something that is also sold by a greengrocer in the same street.

This, I submit, is not the fault of the electrical contractor, but of the manufacturer.

Your remarks in the leading article in respect of the question of an electrical contractor's not selling wireless apparatus were, in a way, quite well timed, but you must not overlook the fact that the proper electrical contractor wants to see where he is first—at least the *business* electrical contractor does. At the present time there is no revival of trade to any great extent, as it is simply the old question over again of the newcomers that must have the work whether it returns any profit to them or not, and I am old enough to understand that this is the very worst form of business, as other people have to live besides yourself. So far from the electrical contractor being apathetic in the matter, I consider from my knowledge of other contractors that they have gone ahead, but they have been all practically on the same lines as myself, and that is, the utter lack of business on the part of the manufacturer has compelled them not to proceed with the matter, as one cannot afford to sell articles which require a very great number of extras to make them work. Some of the quotations which I have received to a perfectly straightforward specification have been just as if a dynamo manufacturer were to supply you with a dynamo without an armature, and on your drawing his attention to the fact, he would reply that, of course, anyone would understand the armature was an extra.

There are, however, two things required by the contractor before he can sell wireless apparatus: one is literature in connection with it, of which—after a deal of pressing—I have obtained a small supply from one maker; and the other is the actual apparatus, which, so far, in my case, has not materialised, so I cannot send out the literature, as I have no apparatus to show.

I should certainly be interested if a few more contractors would state their views, as the sale of wireless apparatus is not the only disadvantage we suffer from.

Contractor.

February 13th, 1923.

High-voltage Power Transformers.

The writer would like to correct an error made in your issue dated February 17th, 1923, *re* type of power transformer. Instead of the words British manufacturers, &c., the words, *practically all* British manufacturers, &c., should have been given. The error was mainly due to the writer's having forgotten, for the moment, the origin of the Met.-Vickers transformer manufacture.

Indeed, almost all British manufacturers of power transformers can turn out the shell type if required, but the question in point is "concentration" of manufacture.

Taking the American continent alone, it is the writer's opinion (based on actual field experience) that, for voltages at and above 60,000 volts, most of the bigger transformer installations of the past were of the shell type "pancake coil" design, with leads coming out at the top of the tank. Some 20 years ago the writer was installing in the U.S.A. the shell type for 60,000-V service, and 16 years ago he was installing them (for 60,000-V operation) in the other hemisphere. Their long-period good service in all climates, at all altitudes, and for all characters of loads, is sufficient recommendation. The writer has given this type just credit in his book "High-Voltage Power Transformers."

William T. Taylor.

London, *February 24th*, 1923.

[We are indebted to Mr. W. T. Taylor for bringing out the facts regarding this subject. The time is at hand when our transformer manufacturers will be called upon to supply apparatus for installation in this country to work at a pressure of 110,000 volts or more, and the correspondence initiated by Mr. Taylor has helped to make clear to prospective buyers the fact that apparatus is already obtainable in this country for these very high voltages.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Charles John Cox, trading as C. J. Cox & Co., Pontefract Road, Castleford, Yorks., electrical and automobile engineer.—The receiving order in this matter was made on February 6th on debtor's own petition. The first meeting of the creditors was held on February 20th at the Official Receiver's office, 21, King Street, Wakefield. Trustee, Mr. W. Tate, Central Bank Chambers, Leeds, appointed February 23rd. The following are creditors:—

	£		£
Avon India Rubber Co., Ltd. ...	21	Northern Radiators, Ltd. ...	13
Anglo-American Oil Co., Ltd. ...	27	Pontefract & Castleford Express	26
Auto Components, Ltd.	21	Premier Motor Policies, Ltd. ...	17
Bankers	916	Pirelli, Ltd.	137
Blackburn, W. S., & Co. ...	42	Rapson Tyre & Jack Co., Ltd. ...	17
Butler, Allan	38	Spencer Moulton & Co., Ltd. ...	17
British Oxygen Co.	14	Short, W. & A.	13
Carter, Bentley's & Gundill ...	12	Sheard & Co.	14
Casperson Bros.	14	Thompson & Brown Bros., Ltd.	133
Chloride Electrical Storage Co., Ltd.	16	United Motor & General Insurance Co., Ltd.	37
Courtnay, T. W., Ltd.	16	Vacuum Oil Co., Ltd.	40
Coghlan, E., Ltd.	27	Winn Rowland	26
Dunlop Rubber Co., Ltd.	59	Wilsons Printers (Castleford), Ltd.	13
East London Rubber Co.	40	Wilson, Miss C.	180
Electrical Engineering and Equipment Co., Ltd.	12	*Yorkshire Evening Post* ...	33
Greenwood, A. I.	16	British Wireless Supply Co., Ltd.	52
Gibson, R. A., & Co.	37	Cox, W. T.	37
Hirst & Sons	20	Inland Revenue	88
Hardy, George & Co.	26	Halifax Permanent Benefit Building Society	358
Leo Swaine & Co., Ltd.	19	The General Motors Acceptance Corporation	360
Motor Union Assurance Co., Ltd.	73	Fawcett, T. P.	325
Mitchell, M. T.	14	Castleford Urban District Council	95
Morley, T. B., & Co.	69	Inland Revenue	205
Northern Engineering Supply Co., Ltd.	38	Stentophone Co., Ltd.	43
Michelin Tyre Co., Ltd.	22	Specialities (Liverpool), Ltd. ...	70

Oswald Greathead & Walter Greathead, trading as Greathead Bros., 50, Burnley Road, Brierfield, Lancaster, electrical engineers and contractors. The following are creditors herein:—

	£		£
Beardsall & Co.	84	Whittaker Bros.	20
Ham & Samson	60	Greenhalgh, C.	12
Palmer, Riley & Co.	23		

Arthur Curtis Stuart and Cyril Perrier (trading as Stuart Wireless Telephone Co.), 109, Kingsway, W.C.—The first meeting of creditors was held on Monday at the London Bankruptcy Court before Mr. D. Williams, Official Receiver. The receiving order was made on February 12th upon the petition of Fellows Magneto Co., Ltd., the act of bankruptcy cited being notice of suspension of payment on November 29th, 1922. The Chairman reported that the debtor Stuart had not attended under the proceedings. It appeared from the statement of the debtor Perrier that he was a British subject born in England. He came out of the Army shortly after the Armistice, and for a time was part proprietor of a night club in Shaftesbury Avenue, in connection with which he had a claim against a former partner for £1,200, which, however, he regarded as of no value. In 1922 he entered into partnership with the debtor Stuart in the business carried on as above; he provided £200 capital, but when he joined the partnership the business was in a bad way financially, and promises of assistance which induced him to become a partner were not forthcoming. A private meeting of creditors was held in November, when a statement of affairs was presented showing liabilities £4,000 against assets valued at £350. It was intimated that an uncle of the debtor Stuart was prepared to put up £1,500 if the creditors would hold their hands, but upon it being found that Stuart had underestimated the amount of the liabilities, the uncle's offer was not put to the meeting, and at an adjourned meeting it was decided to wind up the estate in bankruptcy. Shortly before the meetings were held, the landlord distrained at the factory in Lamb's Passage, Bunhill Row, E.C., and a few weeks before the failure the effects were sold. A few goods left on the premises had been sold to a dealer for £25, and a further £8 might be realised. A distraint had also been levied by the landlord at the offices in Kingsway. No statement of affairs had been lodged under the bankruptcy, but the debtor estimated the liabilities still at £4,000, and the only other assets were book debts, £150, and some company shares of no realisable value. The failure was attributed to broadcasting being held up by the authorities for six months, which prevented sales, the overhead charges going on notwithstanding, and to lack of working capital. In the absence of any offer, the estate was left in the hands of the Official Receiver to be wound up in bankruptcy.

R. W. Russell, electrical engineer and contractor, 30, King Street, Bridlington.—First meeting March 7th, at the Official Receiver's office, 48, Westborough, Scarborough. Public examination March 20th, at the Court House, Scarborough.

P. C. Letherbarrow (Letherbarrow Bros.), electrical contractor, 1, Church Lane, Banbury.—Receiving order made February 21st on debtor's own petition.

F. G. Goss, electrical engineer, 32, Windsor Road, St. Andrews Park, Bishopston, Bristol. Trustee, Mr. F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol, released February 21st.

J. E. Rollinson, electrical engineer, Tavistock Chambers, Beastmarket Hill, Nottingham.—First and final dividend of 2s 7d. in the £, payable March 5th, at Bentinck Buildings, Wheeler Gate, Nottingham.

Company Liquidations.—Connolly Bros., Ltd., insulated cable manufacturers and electricians, Vale Mills, Blackley, Manchester.—This company was ordered to be wound up in July, 1919, and liquidation accounts were lodged showing liabilities £22,906 and net assets valued at £17,442 after deducting £25,121 in respect of loans on debenture bonds and £24,889 for receiver's liabilities. The failure of the company was attributed by Mr. H. Connolly chiefly to severe competition, both at home and abroad. New first meetings of the creditors and shareholders were held last week at the Board of Trade Offices, Carey Street, W.C., to appoint a trustee in the place of Mr. J. M. Henderson, whose death was recently announced. A resolution was passed by the creditors for Mr. Ian Henderson, son of the late liquidator, and partner in the same firm, to fill the vacancy. The shareholders, however, desired the Official Receiver to take charge of the liquidation and the chairman announced that the resolutions would be reported to the Court, which would decide the matter.

Theatrephone Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by Mr. C. J. Day, accountant, of 69, Grove Green Road, Essex, and will be heard in London on March 6th.

Auckland Electric Tramways Co., Ltd.—Winding up voluntarily. All creditors have been or will be paid in full. Liquidators, Mr. C. G. Tegetmeier and Mr. P. M. Rossdale. Meeting of creditors March 9th, at 88, Kingsway, W.C.2.

Fluorundum Flame Carbons, Ltd.—A meeting of members is called for March 30th at 4, Pavilion Buildings, Brighton, to hear an account of the winding up from the liquidator, Mr. F. N. Clarke.

Aluminoid, Ltd.—A meeting of members is called for March 26th at the offices of Messrs. Murray, Burman & Co., 29, Princess Street, Manchester, to hear an account of the winding-up from the liquidator, Mr. F. Selby Burman

British Power Co., Ltd.—A meeting of members is called for March 22nd, at 9, Bedford Row, W.C., to hear an account of the winding up from the liquidator, Mr. T. W. Holland.

Solectric Co., Ltd.—A meeting of members is called for March 30th, at 4, Pavilion Buildings, Brighton, to hear an account of the winding up from the liquidator, Mr. F. N. Clarke.

Telenews (1914), Ltd.—A meeting of members is called for April 5th at 12, Wood Street, E.C., to hear an account of the winding up from the liquidator, Mr. W. Nicholson.

Standard Electric Sign Co., Ltd.—Winding-up order made by the High Court on February 20th. Proceedings are reported on p. 359.

Stockwell & Ohms, Ltd.—A meeting of members is called for April 3rd, at 2, Fenchurch Avenue, E.C., to hear an account of the winding up from the liquidators, Messrs. W. A. J. Osborne and H. Holmes.

Anode Wireless & Scientific Instruments, Ltd.—A petition for the winding up has been presented to the High Court by Idris & Co., Ltd., of 120, Pratt Street, Camden Town. N.W., and Caspar & Co., Ltd., of 33, King's Road, N.W., creditors, and will be heard in London on March 13th.

Acme Welding Co., Ltd.—Winding up voluntarily. Liquidator: Mr. L. A. Kennedy, 236/8, Pentonville Road, N. Meeting of creditors March 8th.

Radio Services, Ltd.—Winding up voluntarily. Liquidator: Mr. M. Hyams, 66, Chancery Lane, W.C. Meeting of creditors March 7th, at 2/3, Furnival Street, Holborn Bars, E.C.

Econ Manufacturing Co., Ltd.—Winding up voluntarily. Liquidator: Mr. H. G. Ash, 6, Broad Street Place, E.C.

City Electric Welding Co. (Newcastle), Ltd.—A meeting is called for March 29th, at 16a, Grainger Street, Newcastle-on-Tyne, to hear an account of the winding up from the liquidator, Mr. J. C. Graham, Jr.

Dissolutions of Partnership.—Burnley Electrical Maintenance Co., 12, Plumbe Street, Burnley, Lancs.—Messrs. J. H. Taylor, W. Burrell and W. A. Burrell have dissolved partnership. Mr. W. A. Burrell will attend to debts and continue the business.

Souness & Green, engineers, Milburn House, Newcastle-on-Tyne.—Mr. C. Souness and Mr. J. K. Green have dissolved partnership. Mr. Green will attend to debts and continue the business at the same address as J. K. Green & Co.

Scientific Wireless Co.—Wireless manufacturers, 188, Brunswick Street, Chorlton-on-Medlock, Manchester.—Messrs. G. Hopkinson, G. Tapley, A. D. Macbeth and A. E. Jones have dissolved partnership. Debts will be attended to by Messrs. Hopkinson, Macbeth & Jones, who will continue the business.

Deed of Assignment.—T. Keating, electrical engineer, 186, Westcombe Hill, Blackheath, S.E.—Particulars of claims to be sent, by March 14th, to the trustees, Messrs. W. A. J. Osborne, and F. B. Darke, Balfour House, Finsbury Pavement, E.C.

Trade Announcements.—Mr. W. M. Woods has removed his London offices to 15 and 16, Railway Approach, London Bridge, S.E.1. Telephone No.: "Hop 6156."

Mr. J. W. Hall, founder and late managing director of The New Switchgear Construction Co., Ltd., has severed his connection with that company and has commenced business on his own account. His London office is at 123, Cannon Street, E.C.4.

Mr. R. J. Bussell has commenced business as an electrician at 12, Manor Road, Yeovil.

Mr. E. L. Palmer, of the Electrical Supply Stores, has opened new showrooms, principally for wireless apparatus, at 11, Fountain Street, Halifax.

We are informed that a company has been registered under the style of Condor Lamps (Great Britain) Ltd., with registered offices at 60, Wilson Street, Finsbury Square, London, E.C.2, to control the sale in Great Britain and Ireland of electric lamps of all kinds manufactured by the Condor Lamp Manufacturing Co., Venlo, Holland. The managing director of the new company is Mr. A. C. Peebles, O.B.E., who is a partner of the firm of Messrs. Charlesworth Peebles and Co. (134, St. Vincent Street, Glasgow), who are sole agents for Condor lamps in Scotland, Ireland and North of England, and who first introduced the Condor lamps into Great Britain over three years ago. That firm will continue to act in the territory mentioned, the business being carried on by Mr. Robert Shaw (Mr. Peebles's partner) who is a director in the new company.

Mr. W. J. Moran has moved to larger premises at 153, Victoria Road, Swindon.

The Brush Electrical Engineering Co., Ltd., announces that the address of its London office and registered office is now 88, Kingsway, W.C.2. Telephone number: "Holborn, 1220." Telegraphic address: "Magneto, West Cent."

The Delco-Light Co., of Dayton (Ohio), U.S.A., having opened a branch of its business at The Hyde, Hendon, states that Messrs. F. S. Bennett, Ltd., will no longer act as the company's *concessionaires* for the United Kingdom and Ireland.

Mr. John H. Scott, who has been with Messrs. McGeoch and Co., Ltd., Glasgow, for the last 23 years, has now commenced business on his own account at 198a, St. Vincent Street, Glasgow, and has been appointed agent in Scotland for Messrs. Drake & Gorham (Wholesale), Ltd., for their specialities, *i.e.*, lamps, fires, &c. Extensive stocks are held, including a full range of ship fittings.

Catalogues and Lists.—The Valor Co., Ltd., Aston Cross, Birmingham.—A circular letter and priced pamphlet advertising the "Valor" fire extinguisher, and an illustrated and priced leaflet dealing with a waste-oil filter.

The British L.M. Ericsson Manufacturing Co., Ltd., International Buildings, 67-73, Kingsway, W.C.2.—A coloured show-card advertising "Opera at Home" by radio-telephony.

Scientific Appliances, 11 and 29, Sicilian Avenue, Southampton Row, W.C.1.—An illustrated catalogue giving prices and particulars of electrical materials and accessories, including accumulators and dry batteries, insulated wires, radio apparatus, lighting fittings, instruments, &c.

Messrs. J. Walton & Son (Nelson), Ltd., Walverden Foundry, Nelson, Lancs.—An illustrated booklet describing the "Bell" electric washing machine.

Messrs. Ferguson, Pailin, Ltd., Higher Openshaw, Manchester.—Catalogue 174 A1, an illustrated brochure dealing with heavy armoured switchgear ("Type H") consisting of oil-immersed circuit breakers.

Messrs. Henderson & Thornton, Ltd., 3, Percy Street, Tottenham Court Road, W.1.—February net trade price list of electrical accessories, including cables, conduits, switch- and fusegear, &c. Also an illustrated leaflet dealing with an electric wash-basin geyser.

The Lancashire Dynamo & Motor Co., Ltd. (associated with the Crypto Electrical Co., Ltd., Trafford Park, Manchester).—A small pamphlet advertising "Crypto" single-phase induction motors of from ½ to 20 b.h.p.

Blandfield Manufacturing Co., 70b, London Road, Croydon.—A leaflet advertising an electric hot-water circulator.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—A fully-illustrated price list of glass shades for electric lamps.

Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts.—Catalogue No. 7, giving numerous illustrations of weather proof lighting fittings for industrial and street lighting. Fully priced.

Mr. Frederick Pratt, 23, Queen Anne's Gate, S.W.1.—A leaflet bearing a number of illustrations of "Zed" fuses in several applications, and an illustrated card advertising the productions of the Ironclad Switchgear Co., Ltd.

The Globe Engineering Co., Ltd., Brighouse.—List No. 5, giving particulars and prices of d.c. motors and dynamos.

Messrs. Siemens Bros & Co., Ltd., Woolwich, S.E.18.—Pamphlets Nos. 840a, illustrating and describing electrical distance thermometers; 840b, dealing with the application of these thermometers to cold storage chambers on ships; and 860a, treating of an optical pyrometer for temperatures above 600 deg. C.

The Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Circulars Nos. 1286/1, horn gap lightning arrester; 1426/1, turbo-alternators; and 1978/1, battery locomotives. Special Publication 7620/1, a brochure giving particulars of the construction and operation of rotary converters; and Descriptive Leaflet 59/5-1, dealing with auto-transformer and star-delta motor starters.

The London Factors & Agents, Ltd., 28 and 39, Parliament Street, S.W.1.—March price list of electrical accessories: accumulators, adaptors, cables, conduit, flexibles, lampholders, switchgear, &c.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 345, illustrating and describing a multiple terminal block for use with radio-telephone head-sets.

Messrs. Earle Bourne & Co., Ltd., Heath Street South, Birmingham.—An illustrated description of the company's rolling and tube mills.

Batteries, Ltd., Redditch.—An illustrated catalogue describing "Ni-Fe" accumulators (Jungner system).

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—June 1st to 14th, International Mining Exhibition; August 31st to September 22nd, Shipping, Engineering, and Machinery Exhibition.

Birmingham.—March 19th to May 12th, National Trade and Industries Exhibition.

Hull.—April 20th to May 5th, International Domestic Economy and Trade Exhibition.

Middlesbrough.—September 21st to October 6th, Domestic Economy and Trades Exhibition.

Belgium (*Brussels*).—April 9th to 25th, Commercial Fair.

Canada (*Toronto*).—August 25th to September 8th, Canadian National Exhibition.

Czecho-Slovakia (*Prague*).—May 16th to 21st, Agricultural Fair.

Finland (*Helsingfors*).—July 1st to 7th, International Samples Fair.

France (*Bordeaux*).—June 15th to 30th, Samples Fair.

(*Lyons*).—March 1st to 15th, Spring Fair.

Italy (*Milan*).—April, Samples Fair.

Latvia (*Riga*).—July 22nd to August 5th, Industrial and Agricultural Exhibition.

Madagascar (*Antananarivo*).—August 15th to September 15th, International Commercial Fair.

Spain (*Valencia*).—May 10th to 25th, Samples Fair.

Switzerland (*Basle*).—April 14th to 24th, Swiss National Fair.

Trieste.—September 3rd to 24th, International Samples Fair.

Chinese Notes.—To facilitate the transmission of military messages, the Inspector-General of the three Special Areas has instructed the Peking Telephone Administration to install a telephone line from Jehol to Niulangshan, and thence to Peking. The Administration has concurred with this proposal, and work will soon be commenced.

The Ministry of Communications has granted a licence to the Shaki Electric Light Co. at Shaki, Kiangsu.

The petition of Fang Cheng, merchant, at Loshiehchen, in the Tehtsing district of Kiangsu, applying for approval to establish an electrical plant (with a capital of $9,000), in conjunction with his rice-milling business, has been granted by the Ministry of Communications.

The Shanghai and Paoshan Tramway Co. in Chapei, Shanghai, will begin constructional operations as soon as registration is granted.

It is reported that General Wu Pei-fu will soon construct a long-distance telephone between Chengchow and Hankow and Wushengkwan, in addition to the lines already operated in Paotingfu, Loyang, and Kaifeng.

The Ministry of Communications has licensed the Poshan Telephone Co., Ltd., in Shantung.

The Nanzin Telephone Co., at Nanzin, Chekiang, has been registered by the Ministry of Communications.

It is reported that the Hsing Hwa Electric Co., at Kiatinghsien, Kiangsu, has been granted registration by the Ministry of Communications.

The Jui Tai Handkerchief Factory, on Yangtszepoo Road, Shanghai, will use electrical machinery to manufacture handkerchiefs.

New Zealand and Trade with Germany.—According to a Reuter dispatch from Wellington, the New Zealand Government will permit trade to be carried on with Germany as from September next.

Socials.—The Athletic Club of the employés of the Yorkshire (West Riding) Tramways Co., a club which has been revived after war-time suspension, held a successful whist drive and dance recently at Wakefield, at which nearly 250 persons were present.

The Halifax Corporation Tramwaymen's Club held its annual whist drive and dance last week at the Ex-Servicemen's Club, when a large company assembled.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, February 27th: Copper (electrolytic): bars, £80, 70s. increase; ditto ditto sheets, no change; ditto ditto wire rods, £90, 70s. increase; ditto ditto h.c. wire, 11½d., ¼d. increase; silicium bronze wire, 1s. 1d., ¼d. increase.

James & Shakespeare report, February 28th: Copper bars, sheet and rod, £104, £4 increase; English pig lead, £30 10s., 15s. increase on last week's prices.

Salaries of Technical Staff.—On February 21st a meeting of members of the Electrical Power Engineers' Association was held in Halifax, in support of the technical staff of the Halifax electricity works, whose salaries the Corporation is endeavouring to reduce. The meeting was addressed by Mr. Thomas, the assistant general secretary, Mr. Telford, Mr. Lunn, and others, who laid stress on the fundamental principle that negotiation with individual undertakings was absolutely unacceptable; negotiations must be conducted on a national basis with the machinery of the Whitley Councils. A resolution endorsing the action of the Association, and pledging the support of the West Yorkshire Section to it, and to the Halifax staff in resisting the attack on the salaries schedule.

Book Notices.—"The Transformer Book" and "The Selection, Treatment, and Testing of Transformer Oil." London: J. G. Statter & Co.—These booklets have been produced by Messrs. Willem Smit & Co., of Nijmegen, Holland, for whom Messrs Statter & Co. are agents. The first deals with the construction of the firm's transformers, and also contains copious notes, with illustrations, upon the installation and working of transformers generally. The pamphlet dealing with transformer oil is also of a general nature, although it describes apparatus of the firm's manufacture.

"The *M.G.C.* Year Book, 1923" (pp. xxv+159). Manchester: The *Manchester Guardian*, Ltd. Price 2s. 6d. net.—This is the third appearance of a handy guide to the industry and commerce of the area of which Manchester is the head. While textiles naturally form the subject of the larger part of the volume, the other important industrial groups are also adequately treated, and the engineering, iron, steel and coal section is of considerable importance. Among the information imparted by the volume may be mentioned the sections dealing with the Stock Exchange, insurance societies, banks, trade associations, educational institutions, and a "Who's Who" of notabilities connected with the city and the surrounding districts. Apart from these sections, which may be considered as principally for reference purposes, there are several articles bearing upon diverse phases of the city's life and work.

"Optical Methods in Control and Research Laboratories," Vol. I, by J. N. Goldsmith, Ph.D., S. Judd Lewis, D.Sc., and F. Twyman, F.I.C., (56 pp.). London: Adam Hilger, Ltd.—This is the second edition of a practical work upon spectrum analysis, absorption spectra, refractometry, and polarimetry. It is well illustrated, and many references are made to standard works upon the subjects dealt with.

"The English Electric Journal," January, 1923 (58 pp.). London: The English Electric Co., Ltd.—The articles in this issue deal with the Leicester central generating station, the electrification of main line railways in France and New Zealand, sheet mills, the power plant and electrical installation at the Dean Clough carpet mills, Halifax, and the "English Electric" asynchronous-synchronous motor. All these are profusely illustrated by very clear reproductions of photographs.

"State Power Plants in Sweden, 1921." Upsala: Swedish Royal Board of Waterfalls.

"Aluminium Facts and Figures" (pp. 80). London: British Aluminium Co., Ltd. Price 5s.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLII, No. 2, February, 1923. New York: The Institute; Price $1.

New Belgian Companies.—There has been formed at Gand, with a capital of 1,000,000 fr., the Société Anonyme Usine Belge de Matérial electrique Vynckler Frères et Cie, for the manufacture and sale of all kinds of electrical material, including "Vyncolite" insulation.

At Anderlecht (124, Rue Birmingham and 25, Quai de Halage), Verse Moulart et Cie have been constituted a company for the manufacture and repair of machine tools, motor cars and the installation and maintenance of electrical plants.

Halage Electrique is the style of a co-operative company established at Liége (11, Quai St. Léonard) for the installation and working of boat-hauling plants, electric traction, &c.

Projected Irish Tariffs.—Last week the Revenue Commissioners of the Irish Free State issued a statement that, as from April 1st, customs duties will be levied upon certain goods coming from external sources, including Great Britain and Northern Ireland.

Wembley Engineering Exhibits.—We have received from the British Engineers' Association a pamphlet giving a first list of exhibitors who have taken place in the Shipbuilding, Marine, Mechanical and General Engineering Section of the British Empire Exhibition, 1924. The pamphlet contains a good deal of information regarding charges for space, classification and other matters of interest to those who are at present considering the question of an exhibit.

The Placing of Contracts by Public Bodies.—In view of the prominence that this subject is receiving in general public circles and in the pages of the Electrical Review—indeed among all who are seriously concerning their minds with the heart-breaking problem of unemployment in the United Kingdom, special interest attaches to a deputation which appeared before Sir W. Joynson-Hicks (Parliamentary Secretary to the Department of Overseas Trade)—in the unavoidable absence of the President of the Board of Trade—on Friday last. The deputation was organised by the British Empire Producers' Organisation (whose chairman, Mr. B. H. Morgan, acted as introductory spokesman), and it included representatives of the B.E.A.M.A., the B.E.A., the National Union of Manufacturers, and many Colonial and other associations. Mr. Morgan said that the deputation represented a preponderating majority of the industries of the entire British Empire, and its opinion, he said, was unanimously in favour of the proposal that it should be obligatory on every Government Department and every railway and public body authority in the United Kingdom to purchase goods entirely of British Empire origin and to employ only British labour on their contracts and work. Not only was the burden resulting from unemployment greater than we could continue to bear, but unemployment was causing a measure of degeneration and social unrest among the workers, constituting a menace to the State and to all schemes of peaceful regeneration. But more than this, the attitude of the Imperial Government in respect of Dominion and Colonial trade caused very deep misgiving in the minds of the British people overseas.

After reviewing the subject at some length, the speaker said that the deputation asked for legislation which would compel all public bodies, Government or local, to give contracts only to British Empire firms, employing British Empire labour and materials, except under the licence of a committee to be set up for the purpose and to represent the spending departments of organised industry and labour. He suggested that in the meantime the Government could put the principle into practice without legislation in all Government contracts and contracts requiring Government assent or guarantee, and urged upon it to do so without delay.

Mr. H. Hirst (British Electrical and Allied Manufacturers' Association) pointed out that where a contract was for £100,000, on an average £60,000 went in wages, so that the apparent saving of £1,000 or £2,000 really meant an enormous loss to the nation. Mr. Terrell (National Union of Manufacturers) pointed out that the Government could insist upon municipalities spending their money within the Empire, as they had to give their sanction to every loan raised by municipalities, and could make it a condition in all of these cases. Mr. Bremner (British Engineers' Association) referred to the serious effect on the engineering industries, and doubted whether they could be maintained in prosperity unless they had this guarantee of public-body contracts. Mr. Dorizzi (National Union of Manufacturers) believed that this was the only country where public bodies were allowed to go outside to spend their money.

Sir W. Johnson-Hicks stated, in reply, that both the President of the Board of Trade and himself were in full sympathy with the object which the deputation had in view, and that the matter had for a considerable time received the careful attention of the Government and particularly of the Cabinet Committee on Unemployment. A distinction must be drawn between contracts placed by Government Departments or by local authorities in respect of works for which they received financial assistance from the State, and contracts placed by local authorities or public utility undertakings not so assisted. In the former group of cases, the Government could lay down such conditions as it thought proper; as to the other cases, it could only make recommendations to the local authorities or companies concerned. The matter was undoubtedly one of great and immediate importance, and the representations made by the deputation would be given full weight.

New French Companies.—With a capital of 280,000 fr., there has been formed at Montreuil-sous-Bois (Seine) (49, Rue des Deux Communes) a company entitled Manufacture de Porcelaine et Appareilage électrique Isola Doncieux, Morel, Vesperini et Cie, for the manufacture and sale of electric porcelain of all kinds.

The Société Cameléon, embodied at Paris (10, Rue de la Pépinère) with a capital of 200,000 fr., has for its object the working of patents relating to electric lighting and its improvement.

There has been formed at Grenoble (Rue Ampère) the Société des Accumulateurs Electriques du Dauphiné, for the manufacture, installation and sale of all articles relating to electricity. The capital is fixed at 300,000 fr. in 500 fr. shares.

Belgian Holidays.—The Chambre Syndicale des Electriciens Belges has declined to give more than moral support to the Chambre du Bronze's projected "lock out" of the workmen in that branch, who claim payment for the legal holidays, including the 1st of May. In the view of the Chambre des Electriciens the bronze trade has too remote a connection with the electrical industry to justify common action.

Sydney's Preferential Proposals.—The retiring Lord Mayor of Sydney has prepared a minute recommending that the City Council should trade for the next two years only with British firms. The Lord Mayor points out there has always been a 10 per cent. preference for British-made goods. The City Council was a very large money-spending corporation, and in consequence of the war and England's struggle to obtain her pre-war standing in the markets of the world, he considered it only right that he should recommend the City Council to restrict all contracts to contractors of Great Britain and her dependencies.—*Tenders.*

Lead.—Messrs. James Forster & Co., in their report dated February 24th, state:—"Transactions have again been on a large scale and total about 6,000 tons for the week. Consumers have bought a little, but as far as we know only for prompt wants. . . . Supply and demand have nothing to do with the course of the market at present; speculation dominates all metals, particularly lead. . . . We have not far to go back for similar speculative activity, *viz.*, the spring of 1920, and this speculative boom will no doubt have a similar result to what followed then. Lead, from £52 per ton, fell to £23 10s. per ton before 1920 was out. All metals are participating in what can only be called undue activity, coming chiefly from American interests, acting on this market."

For Sale.—Gravesend T.C. has for disposal one 2-ton Edison electric vehicle, with tipping body complete. Derby Corporation Electricity Department invites offers for one Ferranti steam alternator and condensing plant, &c. (See this issue.)

Local Exhibitions.—Maidstone.—From February 13th to 20th an electrical exhibition, organised by the Corporation electricity department, was held at the Corn Exchange, Maidstone. The show included every modern domestic electrical appliance, and demonstrations were given where possible. In conjunction with a local catering firm Carron Company ran an electric bakery, from which cakes, &c., were sold to visitors. A special feature of the exhibition was that the cost of hiring and operating appliances was clearly shown, and as the Maidstone rates of charge are reasonable, much interest was evinced. In addition to a number of local contractors and Carron Company the following firms also participated: Jackson Electric Stove Co., Ltd., Metorpolitan-Vickers Electrical Co., Ltd., The General Electric Co., Ltd., Hydrotherm, Ltd., the Hotpoint Electric Appliance Co., Ltd., and the Electric Suction Cleaner Co., Ltd.

Dundee.—The Dundee branch of the Electrical Contractors' Association of Scotland, as well as the Dundee Corporation Electricity Department, have stands at the Modern Homes Exhibition, which opened on February 21st in the city. An "all-electric house," shown by the Corporation, is attracting much attention. In each of the rooms the latest electrical appliances are shown. A system of wiring which does not entail any interference with the walls is shown in a bed-room, while in the kitchen cooking by electricity is demonstrated. Another interesting feature is the electric ironing displays given by Messrs. Stevenson Bros. At the contractors' stand is seen the latest in domestic appliances. The mysteries of raidio-telephony are demonstrated by Messrs. Sturrock and Allan.

Hanley.—At the Potteries General Trades Exhibition, recently held at Hanley, the Staffordshire Electrical Accessories Co., Ltd., Hanley, displayed domestic appliances, including vacuum cleaners, cookers, grills, irons, kettles, coffee percolators, radiators, toasters, &c., together with an attractive selection of glassware. Another exhibit was the "Petter-Light" electric light and power plant for country house, farm and factory. Chief amongst the domestic appliances was the "Tricity" cooker, suitable for a family of from four to six persons. There was also a wide range of electrical fittings.

Electric Lamp Industry in Holland.—The exportation of electric lamps from Holland during 1922 amounted to 3,430 tons, representing a value of 22,313,000 florins, compared with 2,522 tons and 22,101,000 florins in 1921. German electric lamp imports into Holland during 1922 amounted to 178 tons, representing a value of 582,000 florins, against 137 tons and 624,000 florins in 1921.—*Reuter's Trade Service* (The Hague).

Standardisation in Costing.—The second annual costing conference (under the auspices of the Institute of Cost and Works Accountants) will be held at the Connaught Rooms, Gt. Queen Street, London, W.C., on March 9th. The subject will be "Standardisation in Costing." Sir Herbert Austin will preside at the morning session and Sir Max Muspratt in the afternoon. Those interested may obtain tickets from the secretary (38, Grosvenor Gardens, S.W.1).

Unemployment.—The Ministry of Labour returns showed that on February 19th 1,340,200 persons were registered as totally unemployed, 23,571 fewer than a week previously. On the same date the number of workers on "short time" was 55,500, as compared with 52,914 on February 12th.

Small Lighting Sets.—Messrs. Stuart Turner, Ltd., of Henley-on-Thames, are executing an order from Marconi's Wireless Telegraph Co., Ltd., for twelve 300-watt generating sets for use in their overseas stations.

Industrial Exhibit at Tientsin.—Exhibitions, under the auspices of the Chihli Industrial Exhibition Society, will be opened at Tientsin for periods of three weeks from April 8th to October 10th. Among the goods which, according to H.M. Consul-General at Tientsin, could be usefully exhibited by British manufacturers are machinery and tools, electrical supplies and rubber and metal goods. Firms interested should apply to H.M. Consul-General at Tientsin.—*Board of Trade Journal.*

German Telephone Financing.—The Sudicatis Telephone Works and Screw Industry Co. has been formed in Berlin by the Berliner Telephone group, with a share capital of 50,000,000 marks, for the purpose of financing telephone undertakings.

Trade in Germany in January.—The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) has forwarded to the Department of Overseas Trade extracts from the monthly reports of the Prussian Chamber of Commerce concerning the condition of trade and industry during the month of January, 1923. In the electro-technical industry Frankfort reports good sales, while in Berlin there was a weak demand for motors, apparatus, small manufactures and wires. Only the turnover in high-pressure cable improved.

Concert.—The County of London Electric Supply Co.'s Social Society held another successful concert at King George's Hall, Tottenham Court Road, on February 21st. Mr. A. R. Bacon, A.M.I.E.E., took the chair, supported by the general manager and secretary (Mr. F. C. McQuown) and other heads of departments. The first part of the programme consisted of various items contributed by members of the staff, concluding with a clever comedy character impression by Hugh Howell and Dorothy Madgin, the former being an old member of the staff. The songs of Mr. Musgrave, Mr. Parr and Miss Norris were much enjoyed. Mr. Golding gave an excellent violin solo. The coon impression of Mr. Fortescue and the humorous duets of Messrs. Adams and Jones were to the liking of the audience, while Mr. True was an excellent accompanist. The second half of the programme was given by "The Clesco" Concert Party. Mr. W. R. Dossett was responsible for many of the concerted items, and Mr. W. O. Howard, who is the business representative, arranged the programme, &c.

Supply Maintained by Batteries.—According to a report in the *Sydney Morning Herald*, of January 10th, there was recently an interruption in the Sydney electricity supply for about twenty minutes, with intermittent interruptions from 8.20 a.m. to 9.35 a.m. The City Electrical Engineer, in his report, stated that "practically the only portion of the area supplied with electricity by the City Council in which there was not an interference with supply was the centre of the city, and in this portion the supply was maintained by using the storage batteries and the auxiliary supply drawn from the Railway Commissioners' system." The batteries referred to were supplied by the Tudor Accumulator Co., Ltd., the larger one having an output of 5,832 A continuously for one hour, whilst the output of the smaller one is 3,888 A for the same period.

Applications for British Trade Marks.—The following are included among the recent applications for British trade marks. Objections may be lodged within one month from the dates mentioned:—

Radcom. No. 429,877. Class 8. Receiving and transmitting apparatus for wireless telegraphy and telephony. Radio Components, Ltd., 12-13, Henrietta Street, London, W.C. February 21st, 1923.

Claritone. No. 431,069. Class 8. Telephone receiving instruments. Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, Liverpool. February 21st, 1923.

Vio-Ray (lettering and design). No. 425,393. Class 11. Electrical instruments, apparatus and contrivances, not medical, for use with or in the production of high-frequency violet rays for surgical or curative purposes, but not including lamps. Vio-Ray Electric Co., Ltd., 114, Charing Cross Road, London, W.C. February 21st, 1923.

Meters in Czecho-Slovakia.—It is reported from Prague that the Kolben Co. and the Czecho-Moravian Co. are embarking upon the construction of electricity meters, supplies of which it has hitherto been necessary to get from other countries.

LIGHTING AND POWER NOTES.

Ashby-de-la-Zouch.—Electricity Supply.—The Midland Electric Light and Power Co. is applying for a Special Order to enable it to supply electricity for lighting purposes in the Council's area. The Coalville Urban Council has asked the company to extend its mains to the town. The company at present has power to supply electricity in the district for power purposes only.

Australia.—Tasmania.—The Electrolytic Zinc Co. is negotiating with the Zeehan Municipal Council regarding the erection of a transmission line nearly three miles long to convey electrical energy from the municipal power station to the site of the proposed ore treatment works.—*Reuter's Trade Service* (Melbourne).

Barnsley.—Loans Sanctioned.—The Town Council has received sanction from the Electricity Commissioners to loans of £5,000 for mains and services, £8,637 for plant, and £1,500 for meters.

Bexhill.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £11,899 for the erection of a generating station at Little Common. For improving the condensing plant at the Bexhill works the expenditure of £3,108 has been authorised.

Birmingham.—Opening of Nechells Station.—The Prince of Wales, on the occasion of his forthcoming visit to Birmingham and the Midlands, will formally inaugurate the new power station at Nechells.

Canada.—Electricity Scheme.—The Southern Canada Power Co. proposes to increase its capital from six to twenty million dollars in order to carry out extensions which include the installation of another 30,000 h.p. to meet the growing demand for electrical energy for manufacturing purposes.—*Reuter's Trade Service* (Montreal).

Banff.—The Canadian National Parks Branch of the Department of the Interior is to construct a hydro-electric station at Cascade Creek, in Banff National Park, to supply light and power to the town.—*Reuter's Trade Service* (Ottawa).

Ontario.—The Hollinger Consolidated Gold Mines Co. has obtained from the Ontario Government the right to proceed at once with the development of Island Falls, on the Abitibi River, where approximately 16,000 h.p. will be developed at a cost of between three and four million dollars.—*Reuter's Trade Service* (Toronto).

China.—Changchow.—The Chen Hwa Electric Co. is erecting a power station at Changchow, at a cost of $500,000.

The Foochow Electricity Co. has in hand a scheme for the erection of a hydro-electric power station at the waterfalls between Shipping and Lungting, in the Kutien district.

Chorley.—Electricity in Bulk.—The Electricity Committee is in communication with the Lancashire Electric Power Co. with a view to obtaining a bulk supply of electricity.

Continental.—Russia.—The general scheme for the electrification of Russia includes the construction at Belgerode, in the Kursk Government (province), of a single large station of a capacity of 110,000 kW. It is intended that this station shall supply energy to the Southern section of the Moscow-Kursk railway, which is proposed to be converted to electric traction and form a link with the Donetz coal basin onwards from Kursk. Of the station capacity of 110,000 kW it is calculated that 60,000 kW will be required for the needs of the Moscow-Kursk railway, 15,000 kW for purposes of general improvements, 15,000 kW for the agricultural industry, and 15,000 kW for the lighting of villages. The station will be able to afford a supply for a distance of 33 miles on both sides of the railway, and is expected to assist in the creation or expansion of various industries.

Belgium.—The harnessing of rivers is being considered, and among the rivers suitable are the Semois, the Lesse, and the Sûre. It is proposed to utilise a narrow gap above Bodange as the site of a dam and reservoir.—*Electricité pour Tous.*

France.—The Société d'Etudes pour la participation des Industriels à l'Amenagement du Rhône has been formed to utilise the Rhône for the production of electricity.

Croydon.—Price Reductions.—The Town Council has reduced the charges for electricity for lighting on the flat rate from 7½d. to 7d. per kWh, and for heating, from 2d. to 1¾d. per kWh. For business premises, the fixed annual charge of £16 per kW has been reduced to £14 8s., plus 1½d. per kWh instead of 1¼d. For kinemas, the reduction is from 5d. to 4d. per kWh, and for power the charge is lowered from 1¼d. to 1¼d. per kWh.

Darlington.—Correction.—In our issue of February 16th we incorrectly stated that the price of electricity for lighting was being reduced from 7½d. to 6½d. per kWh. The undertaking concerned was West Hartlepool. Mr. J. R. P. Lunn, manager of the Darlington undertaking, who draws our attention to the error, states that the price of lighting energy in Darlington has been 3½d. per kWh since March, 1922.

Dover.—New Plant.—The Town Council having ascertained that a consulting engineer's fee for supervising the installation of new plant at the electricity works to the value of £40,000 would be 5 per cent., plus out-of-pocket expenses, has decided to appoint an engineer to assist Mr. Harpur, the borough electrical engineer, and to place the responsibility on the shoulders of the latter, paying him accordingly.

Evesham.—Opposition to Bill.—The Town Council has decided to oppose the Bill promoted by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. It is thought that the town would be injuriously affected by the provisions of the Bill in its present form, and that amendments may be secured. The Council stipulates that electricity should be brought to the town within two or three years, and that it should have the right to purchase the undertaking at the end of a certain period.

Harrogate.—Price Reduction.—The Town Council has reduced the charge for electricity for lighting from 7½d. to 6d. per kWh.

King's Lynn.—Scheme Abandoned.—The Town Council, having taken a canvass of certain areas in the borough with a view to extending the supply of electricity, has decided, owing to the poor result, not to proceed with the scheme.

Littleborough.—Loan Sanctioned.—The Urban District Council has received sanction from the Electricity Commissioners to a loan of £2,500 for new plant.

London.—St. Pancras.—*Loans.*—The Council is applying to the Electricity Commissioners for sanction to the borrowing of the following sums:—£11,300 for the provision of two motor converters, with switchboards and foundations; and £1,930 for a centrifugal pump for the King's Road station.

Price Reductions.—The Electricity and Public Lighting Committee proposes to reduce the charge for electricity for power and heating purposes from 1½d. to 1d. per kWh, and the Finance Committee recommends that this shall take effect as from the March meter readings.

Fulham.—*Breakdown.*—The electrical engineer, reporting on a recent breakdown, attributes it to the failure of insulation between a conductor and earth. Two controlling panels were destroyed, but the prompt action of the operators prevented further damage. It has not yet been ascertained if the generator was affected, and so far the cost of repairing the damage does not exceed £100. The Electricity Committee has passed a resolution expressing appreciation of the way in which the staff dealt with the trouble.

Stoke Newington.—*Price Reductions.*—The Electric Lighting Committee recommends that as from the last December meter readings, the following scale of charges be instituted:—Domestic lighting, 5½d. per kWh. Power, either 4½d. per kWh for the first hour of the maximum demand, and 1½d. per kWh thereafter; or 2½d. per kWh for the first 5,000 kWh, 1½d. per kWh for the next 5,000 kWh, and 1¼d. per kWh for consumption in excess of 10,000 kWh per quarter. For domestic purposes, 1d. per kWh.

Hire-purchase Scheme.—The Committee also recommends the expenditure of £300 upon the wiring and fitting of approved houses with lighting, heating, and cooking installations, or any of them, and the supply of heaters, on a hire-purchase basis, with a maximum repayment period of five years.

Stepney.—In a report to the Electricity Committee, Mr. W. C. P. Tapper, the borough electrical engineer, points out that three of the existing turbo-generators are being disposed of to make room for new plant. Two of these have already been removed, and the third will be removed when the first of the new 10,000-kW turbo-generators is completed. In the meantime the plant capacity is 2,500 kW less than it was in November last, when the peak load of 16,800 kW was reached. As it may be confidently anticipated that an increase of 2,000 kW will occur during next winter, he urges the immediate conclusion of contracts to ensure that the first 10,000-kW set will be available at the earliest possible moment.

Hampstead.—The Borough Council has approved the following reductions in the price of electricity:—Lighting, from 7d. to 5d. per kWh; and power from 2d. to 1½d. per kWh. The reductions will take effect as from the March quarter meter readings.

City of London E. L. Co.—The company announces further modifications in its charges for the supply of electricity, to which effect will be given as from the date of the meter readings taken at the end of last December quarter. As regards lighting, in each of the winter quarters 8d. per unit will be charged for the first seven units per 30 watts connected, and in each of the summer quarters 8d. per unit for the first three units per 30 watts connected, and 2½d. per unit instead of 4d. previously charged for all energy consumed per quarter in excess of such quantities. For power, 1½d. per unit consumed will be charged, and, in addition, a fixed charge, calculated at the rate of 10s. per quarter per kilowatt of connected demand. The charge for heating will be 2½d. net per unit.—*Financial Times.*

Lydney.—Electricity Supply.—The Rural Council has consented to the West Gloucestershire Electric Power Co. extending its cables into the area.

Luton.—Electricity Agreement.—The Town Council has come to an agreement with the Bedford Town Council as to the area to be included in the extension of the electricity supply. A line of demarcation has been agreed upon, which preserves for Luton an area including Woburn, Flitwick, Silsoe, Shillington, Hitchin, and the adjoining part of Hertfordshire, leaving in abeyance the ultimate allocation of Apsley Guise, Ridgmont, Ampthill, and Arlesley.

Malvern.—Electricity Charges.—The Urban Council has applied to the Electricity Commissioners for an Order fixing the maximum price of electricity, as from September 1st next, at 10d. per kWh. The Council has arranged to give a supply of electricity at a cost of £650 to the Great Western Railway Co.

Loans.—Application has also been made for sanction to the borrowing of £2,000 for mains and services; £1,500 for transformers; and £500 for meters.

Manchester.—An Electric House.—The Corporation electricity Department has had a demonstration house fitted up on the Catterick Hall Housing Estate. It contains everything electrical, including a small cooker; a toaster; a kettle; an electric washer; mincers; and coffee grinders. There is only one coal fire in the house.

Matlock.—Special Order.—The Derbyshire and Notts. Electric Power Co. has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity for all purposes within the area.

Moreton-in-Marsh.—Electricity Supply.—A private company is being formed for the purpose of installing electric light in the town.

Newmarket.—Electricity Charges.—The Newmarket Electric Light Co. has applied to the Electricity Commissioners

for sanction to increase the maximum charge for electricity to 11d. per kWh.

Rochdale.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £7,125 for mains, &c.

Shrewsbury.—Price Reductions.—The Town Council is reducing the charges for electricity from 75 per cent. to 60 per cent. above the pre-war rate.

South Africa.—Paarl (Cape Province).—The proposed electric light extension scheme, estimated to cost £55,000, was recently rejected at a meeting of the ratepayers. A poll has now been taken, with the result that the voting showed a majority against the scheme.

Swansea.—Electricity Supply.—The Town Council has confirmed a recommendation of the Electricity Committee to accept an offer of a minimum guarantee of £2,500 per annum for five years for the supply of electricity to the Kilean collieries. It has further agreed to supply electricity to the British Oxygen Co. at the old power station of the St. Helen's tramways depôt. The rental is £250, rising to £425, per annum. In connection with the proposed supply to this company, a change-over of the system in the St. Helen's district from direct to alternating current is to be made, involving an increased cost of £1,413.

Swinton and Pendlebury.—Price Reductions.—The Urban Council has decided to reduce the charges for electricity for power and lighting from 75 to 60 per cent. above pre-war rates.

Torquay.—Electricity Charges.—In connection with the new electricity works at Newton Abbot, the Town Council has altered the maximum charge for electricity in the Newton Abbot area from 1s. to 10d. per kWh, subject to the Newton Abbot Urban Council not opposing the Corporation Bill.

Loan.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £1,000 for mains.

United States.—Hydro-electric Development.—An application has been filed by the American Super-Power Corporation, of Buffalo (N.Y.), with the Federal Water Power Commission for power to carry out a large hydro-electric scheme, which includes the transmission of electricity from the St. Lawrence River to New York City and the surrounding metropolitan district. Requests have been filed for two preliminary permits, allowing the development of 1,600,000 h.p. in the towns of Waddington (N.Y.) and Morrisburg (Ontario), on the St. Lawrence River. Of this total 920,000 h.p. is intended for the United States and 680,000 h.p. for Canada. Stations are to be erected at Ogden Island and at Barnhart Island. The capacity of the station at Ogden Island will be 700,000 h.p., and that of the Barnhart Island station 1,250,000 h.p. It is intended to develop continuously 600,000 h.p. at Ogden Island, 420,000 h.p. for use on the American side, and 180,000 for use in Canada. At the Barnhart Island plant, where it is hoped to develop continuously 1,000,000 h.p., 500,000 h.p. ultimately will be for use in each country.—*Reuter's Trade Service* (Washington).

Wallingford.—Electricity Supply.—The Town Council has decided to support the Crowmarsh Mill Syndicate's application to install electric light in the town and district.

TRAMWAY AND RAILWAY NOTES.

Continental.—Spain.—It is proposed to commence work on the electrification of the Vascongados railways at an early date. The system consists of 158 km. of narrow-gauge line.

Belgium.—The Société d'Electricité de l'Escaut, of Antwerp, has recently secured a contract for the supply of electricity to the Société Nationale des Chemins de Fer Vicinaux and the Belgian State Railway authorities, for the railways in the Antwerp district.

Edinburgh.—Proposed Tramway Agreement.—The Tramway Committee has under consideration a proposal to link up the tramway system with that of the Musselburgh and District Electric Light and Traction Co. when the Portobello section is electrified. Under the proposed agreement, each will grant running powers over its system for a period of three years.

Glasgow.—Underground Railway Improvements.—The Tramways Committee has proposed that the Subway Railway be electrified and that the entrances and exits to stations be improved. The adoption of moving stairways is also under consideration, while it is proposed to alter the system of signalling.

Japan.—New Electric Railway.—According to a report by the United States Consul at Nagoya, plans are being prepared by the Toho Electric Power Co. to establish a subsidiary company, to be known as the Sangu Electric Railway. Power will be supplied from a hydro-electric power station in the vicinity of Yokkaichi. Work on the scheme will be commenced as soon as sanction from the Government is received.

New Zealand.—Auckland.—A report on tramway finance recently submitted to the Auckland City Council by the Mayor, states that the Council has authorised the following work on tramways loan account:—Ten cars (contract let), £31,000; Great South Road extension and six cars, £85,000; Edendale and six cars, conditional on terms being accepted by the Mount Albert Borough Council, £69,000. The Great South Road extension was started in January, and will be completed by next October. The Edendale extension, provisionally authorised, may follow the Great South Road work in 1924. It is estimated that £15,000 will be required for extensions at Epsom and Ponsonby.—*Reuter's Trade Service* (Melbourne).

Railway Electrification.—In the 1922 New Zealand Public Works Statement, Mr. L. Birks, chief electrical engineer, states that, owing to financial stringency, the question of the electrification of suburban railways has made no further progress, although the electrification of the Otira tunnel is in hand. A special power station, with 2,400 kW of steam power and 250 kW of water power, is being installed for this purpose. Automatic electric power signalling for the railways has been introduced on the Wellington-Hutt line, and it is proposed for other sections.—*Reuter's Trade Service* (Melbourne).

Swansea.—Doubling of Track.—The Swansea Tramways Co. has now offered to pay as its contribution towards the cost of doubling the tramway track on the Sketty Road a rent of £250 per annum, and the Corporation has decided to carry out the work at a cost of £5,684. Application is to be made to the Ministry of Transport for sanction to borrow this amount.

West Yorkshire.—Snowstorm Accidents.—The snowstorm of last week dislocated the tramway and other electrical services considerably. At Bradford, tramway delays were general in the early morning of February 21st until the ploughs had been at work. On the Idle and Thackley route the snow-plough broke down. In Manchester Road, owing to the snow-bound points, a tramcar left the lines, and traffic was dislocated for 40 minutes.

TELEGRAPH & TELEPHONE NOTES.

Afghanistan.—Telegraphic Communication Established.—Land telegraphic communication was established between India and Jalalabad and Kabul, in Afghanistan, on the evening of February 20th.—*Reuter.*

Italy.—New Submarine Cables.—An agreement has been concluded by the Italian Government with a company which will lay a series of submarine cables. One will stretch from Fiumicino (Rome) to South America. Another from the same point will link up the Azores, where it will connect with a cable to New York. The "Italian Cable Company" (La Compagnia Italiana dei Cavi) will lay a third, from Brindisi to Greece. In South America, during the past few months, about sixty million Italian lire have been subscribed for the first-mentioned cable, and subscriptions continue to come in. In Italy a syndicate of Italian bankers is supporting the financing of the scheme.—*The Times Trade Supplement.*

Japan.—Telegraph Communication.—A Copenhagen message says that the Great Northern Telegraph Co. expects in the course of a week to re-establish direct telegraphing to Japan *via* Vladivostock, through the Blagovestschensk-Vladivostock line, which has been broken since the outbreak of the Russian revolution, and is to be re-established in a few days. The Petrograd-Irkutsk-Pekin line will thus be relieved of the whole of the Japan traffic.—*Financier.*

RADIO-TELEGRAPHY AND TELEPHONY.

Broadcasting Licences.—A prosecution with the declared object of making it known that radio apparatus cannot be installed without a licence took place at Royton, Lancashire, on February 21st, on behalf of the Postmaster-General. James Henry Broadbelt, of Crompton, was fined 40s. for having installed apparatus in his house without a licence. He was also ordered to pay 5s. costs on each of two additional charges of establishing and unlawfully working the apparatus. Mr. Broadbelt pleaded that he did not know a licence was necessary. The Wireless Telegraph Act, 1904, provides for a fine not exceeding £100, or imprisonment, with or without hard labour, for a term not exceeding twelve months, and forfeiture of the apparatus.

"The owner of 'listening-in' apparatus is not compelled to allow Post Office inspectors to view it. There is no law on the subject." Mr. E. Moir, of the Radio Association, told the newly-formed South Norwood Wireless Association that this was his opinion, and an official of the G.P.O. gave the *Evening News* confirmation of it. Both Mr. Moir and the G.P.O. official also agree that:—

"The Post Office inspector cannot demand to see anyone's licence. He has no legal status like a police-constable, and if he has any suspicions his only legal course is to apply to a magistrate for a search warrant."

The number of broadcasting licences issued up to the end of January is estimated to be 25,000, and the number of ex-

perimental licences rather more. The royalty is roughly one-seventh of the purchase price. Assuming an average price of £7 per set, the revenue to be derived from the sets purchased by people holding "listening-in" licences would be somewhere about £25,000, though many sets had been purchased before royalties were introduced. The amount obtained from the sale of apparatus to holders of experimental licences would be very small, for the average amateur assembles, and in many cases makes, his own parts. In view of the fact that the cost of running a single broadcasting station is estimated at £20,000 per annum, the company's outlook, from the financial point of view, says *The Times*, is not promising.

France.—Broadcasting.—Plant has been set up at the Ecole supérieure des Postes et Télégraphes de France, where trial is to be made of every kind of apparatus and system suitable for speaking, music and singing. The length of wave used will be 450 metres, and the power on the antennæ 500 watts.

Leafield and Northolt Stations.—On February 22nd, in reply to a question in the House of Commons, Mr. N. Chamberlain replied that it was calculated that each of the stations in question, one of which had been open for about 17 months and the other for about six months only, was now earning sufficient revenue to cover the cost of running the station and meeting depreciation and interest charges.

Traffic Delay.—In reply to a question in the House of Commons on February 26th, the Postmaster-General, Mr. Chamberlain, replied that some delay in the Leafield-Cairo wireless service was occurring, owing principally to the pressure on the station for other wireless services, but on the average the service did not compare unfavourably with other means of transmission, and, as it was steadily improving, it was being increasingly used by the public. The service between Northolt and Bucharest was only started last month. It was still more or less experimental, and was at present confined to certain hours in the day. Traffic was not transmitted by this route unless the delay was likely to be less than that involved in transmission by landline, which sometimes reached as much as seventeen hours.

United States.—Long-distance Broadcasting.—An attempt to radiophone a complete concert to Europe was made on Friday night, February 23rd, at 12 o'clock, New York time—5 a.m. Saturday, London time. The test was made by the Bamberger broadcasting station (W.O.R.), of Newark, New Jersey. It is reported that both speech and music were received in and around London and also at several places in the provinces.

Shipping Rules.—The Board of Trade has issued the Merchant Shipping (Wireless Telegraphy) Rules Amendment Rules, 1923, No. 88, which came into force on March 1st, by which the schedule to the rules, dated July 10th, 1920 (S. R. & O., 1920, No. 976), governing the watchkeeping periods to be observed on ships that carry less than three operators is amended in so far as it relates to zones B and C, *i.e.*, Indian Ocean and Eastern Asiatic Sea; and China Sea and Western Pacific Ocean respectively.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—Buenos Aires.—April 26th. Department of Sanitary Works. Nineteen groups of vertical centrifugal pumps, with electric motors and spare parts.*

Aberdare.—March 16th. Electricity and Tramways Department. Stores, including cable, meters, joint boxes, electric lamps, &c., for 12 months. (See this issue.)

Australia.—Melbourne.—March 1st. Postmaster-General's Department. Telephone and telegraph parts. March 16th. Telephone and switchboard parts and wires. March 21st. Testing and protective apparatus. April 9th. Telegraph and telephone material. April 10th. Bronze and copper wire. April 11th. Positive plates for storage batteries. April 17th. Covered wires. April 18th. Telephone apparatus. April 24th. Telephones and handsets and switchboard cable. (February 16th.)

March 13th. 30,500 dry cells.* March 27th. Underground and submarine cables.*

Electricity Commissioners. Water-screening plant for the Morwell power scheme. (See this issue.)

April 3rd. 5,100 telephone-receiver diaphragms.* April 10th. 686 tons bronze wire, &c.* April 17th. 400,000 copper jointing sleeves, 595 timing clocks.*

March 28th. Victorian Railway Commissioners. Two sets of 3-ph., 20 b.h.p. induction motors, starting apparatus and accessories; one 20-b.h.p. d.c. motor, starting apparatus and accessories.* April 4th. Electric hoist, with trolley.*

Sydney.—April 30th. Amalgamated Wireless (Australia), Ltd. Tenders for modern wireless service between Australia and England and between Australia and Canada. Supply, delivery, and erection completed and ready for operation of a high-power duplex station within 100 miles of Sydney or Melbourne capable of direct communication with England 24 hours daily throughout the year. Suitable corresponding duplex stations to be provided in England and Canada. The Secretary, 97, Clarence Street, Sydney.

Barking.—March 12th. County of London Electric Supply Co., Ltd. Condensing plant and auxiliary apparatus for the Barking power station. (February 9th.)

March 26th. Static transformers. (February 9th.)

Bedford.—March 13th. Electricity Department. Supply of e.h.p., h.p. and l.p. underground cables for 12 months. (February 23rd.)

Belfast.—March 10th. Electricity Department. Stores (including many electrical items) for six or twelve months. (February 16th.)

March 12th. 3-ph., h.p., a.c. switchgear for sub-station. (February 16th.)

March 6th. Tramways Committee. Six or 12 months' supply of tramway stores, including several electrical items. (February 16th.)

Belgium.—March 14th. The Office de l'Electricité, 25, Rue de la Charité, Brussels. Supply and laying of underground cables in connection with the electrification of the Cuesmes and Alost-Nord sections of the Belgian State railways.

April 20th. Municipal authorities of Antwerp. Fifteen electric 2½-ton cranes in connection with the canal docks in the port.

March 15th. Municipal authorities of Lanasken (Province of Limbourg). Establishment of a l.p. electricity distribution system in the town.

March 12th. Municipal authorities of Rockheim (Province of Limbourg). Establishment of a l.p. electricity distribution system in the town.

Schaerbeek.—March 13th. Municipal Authorities. Electricity meters, three automatic circuit breakers, installation of a h.p. distribution and transformer station.*

Burton-upon-Trent.—March 20th. Electricity Department. Relaying l.p. mains. (See this issue.)

China.—Tientsin.—*Extended Date.*—March 28th. Peking-Mukden Railway. Electric signalling material. Specification from Mr. C. P. Sandberg, 40, Grosvenor Gardens, S.W.

Darlington.—March 7th. Electricity Department. One water-tube boiler. (February 16th.)

Dover.—March 8th. Harbour Board. Electrical sundries and cables for 12 months.* Mr. R. Mowll, registrar, Dover Harbour Board, Castle Street, Dover.

Dublin.—March 12th. Irish Free State Postmaster-General's Department. 14 tons bronze wire. (February 23rd.)

Edinburgh.—March 13th. Electricity Supply Department. Two 4,500-kW, 3-phase or alternatively single-phase transformers. (February 23rd.)

Egypt.—Cairo.—March 22nd. Egyptian State Railways. Water-tube boiler, h.p. cables, switchboard panel and transformers for the electric power house, Gabbary. Specifications from Stores Department, Saptia (Cairo), or Gabbary (Alexandria), and at the office of the Administration's Inspecting Engineer in London, Major J. S. Liddell.

Director, Section of the Municipalities and Local Commissions, Savoy House, Cairo. Extension of the electrical system at Zagazig.

France.—Lons-le-Saunier.—Material and rolling stock for the electrification of the Champagnole section of railways. M. Moreau, engineer-in-chief of the Ponts et Chaussées, 3 bis Rue de Vallières, Lons-le-Saunier, France.

Huddersfield.—March 12th, 1923. Town Council. Electrician's work in connection with the erection of 33 workmen's dwellings, Newsome Road. Borough Architect, 1, Peel Street, Huddersfield.

King's Lynn.—March 26th. Electricity Department. One 200-kW converting plant and switchgear. (See this issue.)

Lancaster.—Major Milnes, the Corporation electrical engineer, has been allowed to invite firms to tender for works required in connection with the new generating station in Caton Road, and the distribution station in Marton Street, Lancaster.

Leeds.—March 5th. Education Committee. Repairs to school buildings, including electrical work, required during year ending March 31st, 1924. Particulars from Architect's Section, Education Dept., Calverley Street, Leeds. J. Graham, Director of Education.

Leigh (Lancs.).—Leigh and Atherton Joint Sewerage Board. Motor-driven pump of 2,500 gallons per min. Specifications from R. F. Greenhalgh, engineer to the Board, 30, Bolton Road, Atherton.

London.—Battersea.—March 8th. Electricity Department. One 1,800-kW rotary converter and switchgear. (February 23rd.)

Manchester.—March 13th. Tramways Committee. Supply of steel girder tramway rails. Specifications and forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

Merthyr Tydfil.—March 5th. Board of Guardians. Electrical fittings for six months. Mr. F. T. James, clerk.

Oldham.—March 7th. Corporation Carrying and Cleansing Committee. Refuse disposal plant, including electric motors, for Rhodes Bank destructor depôt. Specifications from Mortimore, Lyon & Co., Mansfield Chambers, St. Ann's Square, Manchester.

Plymouth.—March 12th. Electricity Department. Electricity meters, paper-insulated cables, transformers. (See this issue.)

Salford.—March 12th. Tramways Committee. Five low-type tramcars. Particulars from general manager, 32, Blackfriars Street, Salford.

Sevenoaks.—March 12th. Rural District Council. Electric light installation at offices. J. N. Prior, surveyor, 1, The Paddock, Westerham.

South Africa.—Pretoria.—March 14th. Government Posts and Telegraph Department. Insulators, copper and braided wire, &c.* March 21st. Dry cells.*

Johannesburg.—March 27th. Municipal Council. 250 steel tramway poles.*

Stoke-on-Trent.—March 7th. Electricity Department. Step switch resistance. (February 16th.)

Stockton-on-Tees.—March 10th. District Fund, Gas and Electricity Committees. Stores and articles for six months. (See this issue.)

Turton (near Bolton).—March 13th. Urban District Council. Supply of cable, lamps, meters, joint boxes, iron-clad fuses, sealing chambers and meter boards. Electrical superintendent, Council Offices, Bromley Cross, near Bolton.

Weymouth.—March 10th. Electricity Department. One 350-kW vertical gas engine and dynamo, with gas plant. (February 23rd.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—The municipal authorities of Ghent have recently placed a contract with the Société Générale Belge d'Entreprises Electriques for the establishment of a new generating station in the town.

Dublin.—Electricity and Public Lighting Committee. The Committee has decided to continue for a further 12 months the existing contract for the maintenance of the Corporation's electricity meters.—*Irish Builder and Engineer.*

London.—Stepney.—Electricity Supply Committee.
One ton plumber's solder (£76).—G. W. Neale, Ltd. (Accepted.)
One mile 3-in. earthenware pipes (£114).—Sutton & Co. (Overseal), Ltd. (Accepted.)
½ mile 3-in. 3-way and ¼ mile 4-in. 3-way conduits (£316).—Albion Clay Co., Ltd. (Accepted.)
½ mile "A," 1 mile "B," and 1 mile "C" troughs and covers (£462).—Sutton & Co. (Overseal), Ltd. (Accepted.)
Two tons sheet lead (£74).—Newsome & Co., Ltd. (Accepted.)
Fifty tons of pitch (£394).—Smart's Tar Distillery, Ltd. (Accepted.)
1,000 rolls 1-in. white tape (£85).—J. MacLennan & Co. (Accepted.)
Grit catchers for two chimneys at the Limehouse generating station (£395 each).—Tipton Tub and Tube Co. (Recommended.)
Reconstruction of the existing e.h.p. switchgear at the Limehouse generating station (£19,934).—A. Reyrolle & Co., Ltd. (Recommended.)

Rugby.—Urban Council. Accepted:—
New set of liners for a Diesel engine (£154 10s.).—English Electric Co., Ltd.

Sheffield.—Corporation Cleansing Department.—The D.P. Battery Co., Ltd., has received an order for a "Kathanode" electric vehicle battery for use on one of the Department's vehicles.

Southend-on-Sea.—Town Council. Accepted:—
Electric crane (£1,100).—Smith & Sons.
Repairing and rearranging electric fittings, wires, lamps, &c., Cliffs Bandstand (£474).—F. T. Richard & Co.

Swansea.—Borough Council. Accepted:—
Erection and supply of a new boiler and complete equipment (£11,972).—Stirling Boiler Co., Ltd.

Torquay.—The Town Council has accepted the following tenders:—
Transformer for 500-kW rotary converter (£640); transformer for 300-kW rotary converter (£458); two step-up transformers for 1,250-kW turbo-alternators (£946 each); earthing devices, trifurcating boxes, &c. (£19).—British Thomson-Houston Co., Ltd.
Steelwork for sub-station and electricity offices (£571).—Structural Engineering Co.

FORTHCOMING EVENTS.

Ideal Home Exhibition.—Olympia, W. March 1st to 24th.

Royal Institution of Great Britain.—Saturdays, March 3rd and 10th. At Albemarle Street, W. At 3 p.m. Lecture on "Atomic Projectiles and their Properties," by Sir Ernest Rutherford, F.R.S.
Thursday, March 8th. At 3 p.m. Lecture on "Water Power of the Empire," by Mr. T. Stevens.

Chief Technical Assistants' Association.—Saturday, March 3rd. Annual general meeting. At 6.15. Annual dinner.

Institution of the Rubber Industry.—Monday, March 5th. At the Engineers' Club, Coventry Street, W. At 7.30 p.m. Paper on "Telegraph Cable Manufacture, Rubber and Gutta-Percha," by Mr. H. Savage.

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 5th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Control in Industry," to be opened by Mr. J. H. Parker.
(Wireless Section).—Wednesday, March 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Development of Naval High-Power Valves," by Mr. H. Morris-Airey.
(North-Western Centre).—Tuesday, March 6th. At the Engineers' Club, Manchester. At 7 p.m. Popular lecture.
(Dundee Sub-Centre).—Thursday, March 8th. At the University College. At 7.30 p.m. Paper on "Hydro-Electric Schemes," by Mr. H. Richardson.
(Western Centre).—Monday, March 5th. At the Merchant Venturers' Technical College, Bristol. Joint meeting with the Institution of Post Office Electrical Engineers. Lecture on "Long-distance Installations," by Mr. E. H. Shaughnessey.
(London Students' Section).—Friday, March 9th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Address by the President, Mr. F. Gill.
(South-Midland Centre).—Students' Section.—Friday, March 9th. Radio demonstration and discussion.

Roentgen Society.—Tuesday, March 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary meeting.

Electrical Society of Glasgow.—Tuesday, March 6th. Paper on "Electric House (Practical Results)," by Mr. R. Hardie; annual general meeting.

Nottingham Society of Engineers.—Wednesday, March 7th. At the Welbeck Hotel. At 7.30 p.m. Problem night.

Greenock Association of Electrical Engineers.—Wednesday, March 7th. At 22, West Stewart Street. At 7.45 p.m. Paper on "Wireless Telegraphy," by Mr. G. G. Reid.

Industrial League and Council.—Wednesday, March 7th. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "Control of Industry," by Mr. A. Dalgleish.

Institute of Metals.—Wednesday and Thursday, March 7th and 8th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. Annual general meeting

Scottish Engineers' Association.—Thursday, March 8th. At the Royal Philosophical Society, Glasgow. Address on the "Dalmarnock Power Station," by Mr. R. B. Mitchell.

Chelmsford Engineering Society.—Thursday, March 8th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Artesian Wells and Pumping Plants," by Mr. F. C. Paget.

Junior Institution of Engineers.—Friday, March 9th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Steel Works Equipment," by Mr. R. C. D. Fell.

Edinburgh Electrical Society.—Friday, March 9th. At the Philosophical Institute. At 8 p.m. Paper on "Colliery Plant," by Mr. E. Cunningham.

Birmingham and District Electric Club.—Saturday, March 10th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Wave Transmission," by Mr. W. Dinwoodie.

Salford Technical and Engineering Association.—Saturday, March 10th. At the Royal Technical College. At 7 p.m. Paper on "Jigs and Fixtures," by Mr. T. Elliott.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped envelope.

The makers or suppliers of the following devices are asked for:—

Girder adjustable lighting fittings (for machine tools, &c.).

NOTES.

Appointments Vacant.—Chair of electrical engineer (£1,000) Glasgow Royal Technical College; general accounts clerk (£167) for the Treasurers and Accounts Department, Hackney Borough Council. (See our advt. pages to-day.)

The Oldham Turbine Accident.—On February 10th two 7,500-kVA turbo sets were in operation in the Corporation station at Oldham. In shutting down one of these sets the excitation was cut off and the machine speed increased in order that it might be tripped out by the emergency over-speed governor, as is usual practice when testing such an emergency feature. When a speed slightly below 3,300 r.p.m. had been reached (the normal tripping speed of the emergency governor), the rotor opened out and jammed in the stator bore. The heat due to friction caused the oil from the bearings to catch fire, and it was necessary to call out the Fire Brigade to extinguish the flames. This was done in a few minutes.

It was found that the cast-iron frame surrounding the laminations had been fractured. The rotor shaft had been broken off at both ends and the ring of the stator laminations with the rotor inside had fallen into the pit below the machine. The generator foundations sustained some damage. The coupling bolts between the turbine and generator had been sheared off and a piece of the bearing-housing cover on the turbine had been broken. The turbine, however, continued to run for several minutes after the accident. A piece of metal struck the emergency governor trip lever on the neighbouring set, which was running, and shut the machine down.

An examination of the rotor (carried out as thoroughly as circumstances would permit) by the suppliers of the forging as well as the Metropolitan-Vickers engineers, revealed the fact that a large internal defect had been the cause of the trouble; apparently the rotor had opened up on a plane through the axis, bringing the periphery of the rotor into contact with the inside bore of the stator laminations. The friction between the rotor and stator laminations had caused the stator core to revolve and fracture the cast-iron stator frame and the bedplate, leaving no support for the stator, which, as mentioned above, fell down into the pit, breaking the shaft and carrying the rotor with it. The ring of stator laminations acted as a "bombproof" shield and prevented the parts of the rotor from flying outwards, and this fact was undoubtedly responsible for the small amount of damage which was done external to the machine.

The amount of damage done to other apparatus in the station and to the station buildings was comparatively trifling, being confined to a few cracked slate panels on the switchboard, one or two small broken castings, and other small parts. The most serious external damage appears to have been in connection with the glass roof resulting from the flames rising from the burning oil. Two of the station attendants were very slightly injured.

The machine in question had been in operation since December, 1921, and its rotor was a duplicate, as regards peripheral speed and stresses, of over two dozen sets, some of which have been in operation for over six years. The Metropolitan-Vickers Electrical Co., Ltd., has supplied some 300 machines of this type with solid forged rotors, some smaller and others much larger than the one to which the accident occurred.

Fatalities.—A verdict of "Accidental death" was returned at an inquest upon a colliery clerk at the Hetton Lyons Colliery Office, Durham, recently. It was stated that the deceased was working at an electrically-driven printing machine, and it is presumed that his bare arm came in contact with a cable which had slipped out of its terminal.

An inquiry was held at King's Cross on February 21st into the death of Edilio Bellidori who, it was stated in evidence, was freeing a pipe which had become blocked, and lifting an electric lamp, received a fatal electric shock. The coroner adjourned the inquest for further evidence.

Mr. L. Birks, chief electrical engineer of the New Zealand Public Works Department, sends us particulars of an extraordinary fatal accident, which illustrates again how essential it is, in handling high pressures, to observe the safety precautions in absolute detail. A 3,000-V fuse had blown on an 11,000-V pole transformer station at Te Aroha and the lineman and his mate went out to replace it. The transformer is supplied by means of a throw-over switch from either of two 11,000-V circuits running across at the top of the pole station. The throw-over switch has a central dead position with a break of 9 in. from either set of jaws. The lineman unlocked the quadrant and opened the air-break switch, according to the evidence, to a distance of only about 4 in. instead of the full 9-in. break, and proceeded to climb from the platform to the 3,000-V fuses making contact with the dead 11,000-V leads. His mate beneath the platform then heard a discharge and the lineman fell dead on to the platform. On removal of the corpse, the dead body of a sparrow was found beneath it, quite warm and with the beak and legs burned off. When examined, the connections below the throw-over switch were all dead and safe and the deceased had not gone up within several feet of the live leads. Evidently the sparrow was killed simultaneously with the man, and the accident was apparently due to the sparrow having made connection across the half-opened air break switch, the momentary arc through the sparrow's body being sufficient to cause the death of the lineman.

There is a regulation that all h.p. conductors shall be earthed before being touched, but like so many good regulations it was not observed in this particular case.

The G.E.C. Research Laboratories.—The opening ceremony of the new research laboratories (about which we hope to publish further particulars next week) of the General Electric Co., Ltd., at Wembley, took place on Tuesday afternoon in the presence of about 900 guests, leading scientists, engineers, and representatives of the various universities, institutions, and industrial organisations.

Mr. Hugo Hirst (chairman of the G.E.C.), occupied the chair and outlined the circumstances that led up to the establishment of the laboratories—the fulfilment of a dream he had cherished for many years. The war had proved the electrical industry to be a key industry, which fact had taught the firm the lesson that it must hold its own under any conditions. The firm was prepared to produce everything that was necessary for the equipment of the largest power station, of a complete electric railway, telephone exchange, battleship, or West End mansion. Such a concern could not be dependent on foreigners for new inventions, the improvement of processes and methods, &c., and if the laboratories could solve some of their problems they would have justified their existence. The war taught this country, he continued, that industrial dependence on foreigners might lead to political and national death and important though the work of the laboratories would be to the firm itself, it was hoped that the community at large would be benefited in no less a degree.

The Rt. Hon. Lord Robert Cecil, K.C., M.P., pointed out that the task before the people of this country was for every individual to strive to do something to repair the waste of war and enable the world to function better than it did before. To do that they must increase the output of human energy and skill. The laboratories that were being opened would enable greater results to be obtained from the materials handled, but they must go beyond that and the spirit of research must percolate through the whole industry. As industry must be organised in a singularly unintelligent fashion which failed to make use of the highest faculties of those engaged in it. By the neglect of brains in this country a great source of wealth had been allowed to run to waste. Science had no territorial boundaries, and interchange of scientific knowledge was one of the first duties of civilised man. The work being done in those laboratories might make happier and better the lives of people all over the world.

Sir Joseph Thompson, O.M., F.R.S., said that the ceremony was a conspicious example of the increased importance that was being attached to the application of research to industry. It was extraordinarily difficult to judge what might come out of a new invention, and the most important thing about it was the spirit that would be introduced into the whole conduct of the industry. If they did not use their brains, they would soon have no brains to use, and he would like to see the spirit of research extend into the factories where there was an ample field for it. Sufficient attention was not devoted to the difficulties met with in workshops.

Mr. Clifford Paterson, O.B.E. (director of the laboratories), and Mr. Christopher Wilson (director of the G.E.C., and manager of the Osram lamp works), also spoke, and the visitors were then conducted over the laboratories wherein many most interesting exhibits and instructive demonstrations had been arranged.

L.E.E. Re-Union.—The No. 4 Company (London Electrical Engineers) is holding its annual re-union and dinner at the "Florence Restaurant," Rupert Street, Shaftesbury Avenue, W., on March 10th at 7 p.m. Any members of the company who have not received a notice should communicate with Mr. A. E. Beach, Metal Works, Shawfield Street, S.W.3.

British Electrical and Allied Industries Research Association.—At the annual general meeting of the Association, held on January 12th, at the Institution of Electrical Engineers, Mr. E. B. Vignoles (in the chair) presented the annual report and accounts, and the director in giving an account of the work of the year, referred to the facilities for co-operation between manufacturers, users, and independent experts, afforded through the committees of the Association, in dealing with the technical problems of the day. He drew special attention to the report on the researches on the heating of buried cables, that was submitted at the March 1st meeting of the Institution of Electrical Engineers, and to the important researches on electric control apparatus now in progress. During the course of the discussion, Mr. Ll. B. Atkinson and Mr. C. P. Sparks, commenting on the work which had been done on buried cables, stated that the saving to be effected by the industry by the application of the results obtained would alone cover, in a very short time, the whole of the expenditure of the Research Association to date on all its researches.

The chairman remarked that the position of the Association was very different from what it had been a year ago, and believed that it would be easier in the immediate future to undertake, with good hope of success, propaganda for the broadening of the basis of membership and securing further support for the Association.

The Chairman, expressing appreciation of the past services of Mr. C. H. Wordingham to the Association, moved that he be appointed the first President of the Association. The resolution was carried unanimously with acclamation. Mr. F. Gill, President of the Institution of Electrical Engineers, was elected a member of Council in place of Mr. J. S. Highfield, retiring, and other retiring members of Council were re-elected. Messrs. Price Waterhouse & Co. were re-elected auditors.

Electrical Power Engineers' Association.—The members of the North-Eastern Division of the Association held their annual dinner at Newcastle-on-Tyne on February 23rd, Mr. A. W. Crompton presiding. Mr. W. J. Oswald (vice-president of the Association) in the course of some remarks said there were undertakings, such as Halifax, seeking to undermine the schedule of salaries. Municipalities should realise that the industry was a national one and not a local element, to be used in local politics as a pawn. The men on whom the responsibility rested were members of the E.P.E.A. They wanted a status at least equal to the professions of law and medicine.

Mr. C. Turnbull (electrical engineer, Tynemouth) said that one great function of the E.P.E.A. was to act as a go-between for technical and commercial men.

Mr. J. Edgar (electrical engineer, South Shields) said 43,000,000 kWh were sold in 1897 and 5,157,000 kWh in 1922. The industry had, to a great extent, conserved the coal supply of the nation.

Other speakers were Mr. G. J. Porter, Mr. G. N. Wrightson (Middlesbrough), and Mr. J. A. Halliday.

INSTITUTION NOTES.

Institution of Electrical Engineers. — Kinematograph Films.—At the special meeting of the Institution on February 22nd, Mr. B. Welbourn exhibited a kinematograph film, in two parts, illustrating the electrification of the Chicago, Milwaukee & St. Paul Railroad. In his introductory remarks he pointed out that this was the first trans-continental line in America which had made a commencement with main-line electrification, and a great pioneer work had been done in electrifying the line at 3,000 volts, d.c., with only, so far as he knew, the experience of the Butte, Anaconda and Pacific Railway behind them, which operated for some time at 2,400 volts, and was now working in conjunction with the Milwaukee system. Power was obtained from the Montana Power Co., and was transmitted along a single 100,000-volt, three-phase circuit, which paralleled the track the whole way. The length of electrified route was approximately 650 miles, mostly single line, with turn outs and sidings, making a total single track equivalent of 850 miles. The portion which had been electrified ran from Tacoma, on the West Coast, right up into the mountains, where there was a break of 200 miles from Spokane, when the electric system began again and continued for over 400 miles further. As regards the power supply, it would no doubt interest supply engineers in this country that the railway company did not consider it necessary to erect its own power station, but was content to rely upon the power company. The 100,000-volt line was tapped into sub-stations placed about 32 miles apart, which in the aggregate contained nearly 90,000 kVA of transformer plant The equipment in each sub-station consisted of two or more 3,000-volt, d.c. sets, driven by a synchronous motor, to which were coupled two 1,500-volt, d.c. generators. The catenary equipment was very simple, and consisted of a steel messenger wire from which were supported two trolley wires side by side. The film showed that the construction was of the simplest possible character, presumably dictated by financial considerations at the time, said Mr. Welbourn. The poles were wood throughout, and had, he believed, been cut from the forests through which the line ran. The poles carried quite a number of wires; for instance, there was the negative earth feeder, the 4,400-volt signal wires, the telephone circuits, and the trolley wires; there were also the automatic signalling arrangements fitted on the 4,400-volt signal wires. At the signalling points this pressure was transformed down to 110 volts, and again transformed down to 23 volts at the signal lamps. The track was of special interest to railway and civil engineers. The severest portion of the line involved a 21-mile stretch in the Saddle mountains, of 1.7 per cent. gradient, the maximum height to which the line climbed being 6,000 ft. At another point the gradient was 2.2 per cent. The track was an excellent piece of work, and was ballasted throughout very much in the same way as our own lines were here, so that dust was kept down to a minimum. A great deal of the interest in the line was centred in the locomotives, of which there were two types. There was a gearless type, which weighed 260 tons, and had a continuous rating of 3,200 h.p., and there was also the quill type, which weighed 284 tons and had a continuous rating of 3,400 h.p. These locomotives were fitted with pantograph collectors and the current collection was excellent. (The operation of these was well shown by slowing down the film, which enabled a good idea to be gained of the working of the pantograph.)

In conclusion, Mr. Welbourn said he felt that the value of these films was the interest they must have for young engineers intending to go abroad, as they would help to enable them to visualise the conditions which would have to be met in other countries than our own.

North-Western Centre.—*Annual Dinner.*—The annual dinner of the North-Western Centre, held at the Manchester Midland Hotel on February 23rd, was attended by about 160 members. Mr. A. S. Barnard presided. Dr. S. Z. de Ferranti, in proposing "The City and Trade of Manchester," said that world trade was essential to Manchester, and they naturally looked to the colonies to be an outlet for their manufactures. Unfortunately, however, laws were so framed in some of the colonies that preference designed in favour of this country worked out in favour of Continental nations. It was, therefore, for everyone, and especially the Chambers of Commerce, to see that English manufacturers obtained the best chance of selling goods in every part of the British Empire.

Mr. W. Clare Lees, O.B.E., President of the Manchester Chamber of Commerce, replied to the toast, and spoke of the wonderful future that scientific discovery held in store for them.

The toast of the "Institution of Electrical Engineers" was proposed by Sir Henry A. Miers, D.Sc., F.R.S., Vice-Chancellor of the University of Manchester. He said that there was no profession in which research and investigation played a more important part than that of electrical engineering, and there could not be too much co-operation between those whose business it was to study theory and those who were practitioners. Electrical engineers were becoming more and more specialists, and their profession was becoming divided into special branches, each of which might conceivably be using a language that was becoming less and less intelligible to other branches of the profession. This could be corrected by their keeping an eye on the factors and conditions that were common to all branches, and retaining language that was applicable to all of them. It was important to anyone who made a study of a subject to be able to explain himself in simple language to others who had no knowledge of the subject. If it were possible to have some of the public lectures at the university broadcast it would be a great means of conveying information to the hundreds of thousands of working-class people in that district who were thirsting for knowledge.

Mr. F. Gill, O.B.E., President of the Institution, replied to the toast. He did not think that the importance of radio communication had been sufficiently appreciated. It was being looked upon too much as a luxury, whereas its main function was that of a tool for transport. It would be a first-class thing if competent men would give lectures to be broadcast amongst the thousands of enthusiastic listeners-in. Referring to the progress of the Institution, he said that during the last four years no fewer than 3,000 members had enrolled in their ranks, and they were faced with the problems of a real severe growth. It was obvious that they could not handle a big growth such as they had had and were having from a central point. The local centres had done splendid work and had, altogether, more than half the total membership of the Institution. Manchester had shown one of the ways of dealing with growth by assenting to the application from Liverpool that the latter city should become a centre by itself. He was sure they were going to have a big growth in membership, and already some people were asking what would happen when everyone was an electrical engineer.

The final toast was that of "The Guests," which was proposed by Alderman W. Walker, past chairman of the North-Western Centre, and replied to briefly by Mr. George Hughes, C.B.E.

Informal Meetings Section.—At the meeting of the informal section, on February 19th, Mr. E. F. Hetherington was in the chair when Mr. F. Peake Sexton opened a discussion on "Esprit de Corps." He traced the genesis of "Team Spirit" and class interest, and said that he thought that the lack of patriotism and national feeling in individuals was very often because they had failed to appreciate or had jumped over the stages, the family ties, professional prestige, and national pride to a universal brotherhood idealism. Other trades and professions had developed from the old trade guilds and had inherent the esprit de corps that was almost non-existent in the electrical industry.

He instanced cases of members of the industry abusing to a third party the advice or craftsmanship of another electrical man—he read an extract from a letter written by a borough electrical engineer to the effect that within his district: "We do not recognise the rules of the Institution of Electrical Engineers, but have our own regulations, &c."—a quite illegal attitude, by the by, if made a condition for connecting an installation, and he compared the conditions prevailing in the industry with those of the medical and legal professions, where etiquette was so powerful. He could not propose a remedy, and appealed for more pride in their industry and in membership of the Institution, and for more care in criticising the operations of fellow engineers. Major G. H. Spittle led the discussion with a humorous speech describing regimental and corps pride, upon which which military discipline was fostered. Messrs. J. R. Bedford, J. Coxon, A. G. Hilling, E. F. Hetherington, H. H. Long, W. Lunn, F. Pooley, W. E. Rogers, M. Whitgift, and W. L. Wreford also spoke.

Smoking Concert.—On Monday last, the Informal Meetings Section held a smoking concert at the Engineers' Club, London, Mr. W. E. Warrilow presiding; there was a large attendance, and an excellent programme was performed and was greatly appreciated. Special commendation should be given to Miss Nora Bancroft, Miss Winifred Mansfield, and Mr. Jack Millard for their items, whilst Mr. J. Corthesy, of the I.E.E., and Major C. H. Montgomery, both amateurs, more than held their own with the professionals, and Miss Margaret Briden was an accomplished accompanist. The concert sub-committee (Messrs. Avila, Grierson, and Warrilow) is to be congratulated on its organisation of the entertainment, which was thoroughly successful, and went with a swing from start to finish.

Institution of Railway Signal Engineers.—At the annual meeting, on February 14th, Mr. R. J. Insell, Chief Assistant Signal Engineer, G.W.R., Reading, was elected president, and Mr. W. J. Thorrowgood, Signal and Telegraph Superintendent, S.R., Wimbledon, vice-president. The annual report shows that during the year the membership increased by 17.3 per cent. to 434.

Radio Society of Great Britain.—On Friday, March 16th, a lecture will be given by Mr. L. F. Fogarty at the Institution of Electrical Engineers, Victoria Embankment, W.C., at 6.30 p.m., on "Accumulators, Dry Cells and the Currents Used in the Reception of Radio Telephony, Illustrated by Experiments." Cards of admission can be obtained by forwarding a large stamped envelope to the Hon. Secretary, 32, Quex Road, West Hampstead, N.W.6.

REVIEWS.

Radio-Telephony for Amateurs. By Stuart Ballantine. Pp. 296; figs. 153. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

The author, who is a consulting engineer in America, says "that we all have our own ideas as to what the ideal radio book for amateurs should be like," and this one may be his ideal, but it is certainly not ours. The actual writing, he says, "was undertaken on short notice," but even so, grammatical errors and obscurities of expression, both of which are numerous and irritating, might have been cleared up in the proof stage. But Mr. Ballantine himself seems uneasy on this point, as he finishes his preface with the following typical sentence: "Other minor errors of typography and circuital infelicites he [the reader] may magnanimously overlook or silently emend."

The book contains, with 153 illustrations and diagrams, a mass of information on arrangements for transmission and reception by radio-telephony. This information is given, however, in a form more suitable for reference than for continued study. As a book of reference for the amateur it may have its uses, but there are many really good text books now available for this purpose at no greater cost.

Letters of a Radio-Engineer to his Son. By John Mills. Pp. 265; figs. 136; plates XII. London: George Routledge and Sons, Ltd. Price 10s. 6d. net.

Mr. Mills is a well-known American radio engineer in the employ of the Western Electric Co., and an old hand at explaining the new knowledge of physical phenomena in a clear and simple manner. He has written this book in the form of letters to a boy, and no mathematical or electrical knowledge whatever is required for its complete understanding, the reader being taken through the fundamental theory of radio-telephony in a conversational and attractive manner. In such a book much of the explanation must necessarily depend on analogy, and it is refreshing to find in this one a number of new and simple analogies which will clear up many difficulties for readers who, without scientific training, wish to obtain an accurate grip of the subject. A study of the book will make it possible also for such readers to construct their own sets in an intelligent manner, one of the letters being devoted to an explanation of the best lines on which to start and develop experimental work.

A few of the explanations will appeal more to American than to English readers, such as that of a characteristic curve where the ordinates are likened to streets, and the abscissæ to avenues.

There are 12 plates and 136 drawings, and the pleasing practice of repeating diagrams so as to obviate back reference is adopted.

Altogether this is a book which can be confidently recommended to the amateur who has not had an electrical training, but who wishes to experiment intelligently with radio-telephone apparatus.

The Nitrogen Industry. By J. R. Partington, M.B.E., D.Sc., and L. H. Parker, M.A., D.Sc., F.I.C. Pp. xvi+336; figs. 23; plates XIX. London: Constable & Co., Ltd. 1922. Price 21s. net.

The authors have given a volume which touches upon almost every aspect of the nitrogen industry, giving in a highly interesting and informative manner a detailed survey of the various modern methods of nitrogen fixation processes and the allied industries, betraying an intimate and comprehensive knowledge of the whole question. It includes authoritative views on the inactivity and lethargic policy of those in authority in this country, regarding the nitrogen industry in its relationship to the use of nitrate in the fertiliser, explosives and dye industries, and cites the war-time experience of the evils of relying upon foreign nitrate supplies. The authors make a plea for the nitrogen industry in the national interests.

The book is sound and scientific, a large proportion of the material being based on the experience of the authors, is written in a readable manner, and in the main can be intelligibly followed by non-technical readers.

The volume comprises three parts. Part I deals with "Nitrogen Products and Chile Nitrate," and gives an interesting account of the liquefaction and rectification of nitrogen from the atmosphere, and an ably written dissertation on the Chile nitrate industry. Eleven pages of this consists of details of the war-time production and statistics connected with the manufacture of nitric acid at H.M. Factory, Gretna. Part II deals with "By-Product Ammonia and Ammonium Sulphate Manufacture," including a sub-section on "Ammonium Sulphate in Agriculture." This is founded on the "Rothamsted Experiments, 1917 (Hall)," and gives a well-written *résumé* of the experiments on wheat, showing the importance of nitrogenous fertilisers in relation to food production. Part III comprises "Nitrogen Fixation Processes." This is divided into four sections, (*a*) Synthetic Ammonia; (*b*) The Cyanamide Process; (*c*) The Arc Process; and (*d*) The Oxidation of Ammonia. Descriptions are given of the various processes, and are well illustrated by means of sectional drawings of plant and plate photographs of the various types of Norwegian power plant. The concluding sixty pages of the section on "The Oxidation of Ammonia" are devoted to the classic researches of the authors on the catalytic oxidation of ammonia.

There are but few errors, and they could no doubt be corrected in a future edition, *e.g.*, page 92 refers to figure 10 as being Grüneberg and Blum's Still, whereas it is actually a drawing of Wilton's Ammonia Still. In the list of plates, there is what appears to be a printer's error, Dorr being misspelt "Door." A valuable addition and asset to the book would be a bibliography of references to the literature on the nitrogen industry.

Drs. Partington and Parker are to be congratulated on having presented a volume on "The Nitrogen Industry" in a convenient and striking form. It is a mass of information, systematically arranged from a technical, statistical and commercial standpoint, covering an extensive field, communicating the matter tersely, fairly and proportionately. The subject has been treated in a highly practical and skilful manner throughout, and the style is bright, interesting, and of a high literary quality. The treatise reflects great credit on the authors and publishers, and will be read by all desirous of being *au fait* with the development and present position of the nitrogen industry.

The book is well printed and bound, the illustrations are good, and is a volume deserving of a place in every scientific and technical library. B. W. L.

Mast and Aerial Construction for Amateurs. By F. J. Ainsley, Assoc.M.Inst.C.E. Pp. 82; figs. 65. London: The Wireless Press, Ltd. Price 1s. 6d. net.

All amateurs who wish to erect an outside aerial efficiently and cheaply would be well advised to study this book. Sound and simple methods for the construction and erection of the types of masts required are explained clearly, with the aid of 65 detailed diagrams. Unlike so many books for amateurs recently published, this one does supply a real want.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

At the Dublin Corporation meeting on February 19th, Alderman Hubbard Clark moved that a recommendation of the Finance and General Purposes Committee, in furtherance of a report from the Electricity and Public Lighting Committee, to pay Mr. L. J. Kettle, city electrical engineer, a fee of £100 for services rendered in connection with the Liffey water-power scheme, be sent back to the Finance Committee for reconsideration. He said that Mr. Kettle had shown great interest and rendered valuable service in his own department, but it was a mistake to call this a grant or fee. He said he would not be a party to making a grant for services rendered to his own department by any official getting £1,400 a year. Mr. M. J. Moran said that the amount covered nothing but out-of-pocket expenses. Mr. Rice (law agent) said that legally the amount would not be paid as expenses, but payment ought to be made as extra remuneration, as Mr. Kettle did work which was outside the terms of his contract. Mr. James Moran supported the recommendation. On a division it was decided that the report be referred back to committee.

A foreign contemporary states that Dr. Walter Rosenhain, head of the metallurgical department of the National Physical Laboratory, is touring the eastern part of the United States at present, lecturing to various educational institutions and technical societies.

According to the *Commonwealth Engineer*, Mr. A. Cameron, chairman of the Melbourne Tramway Board, is to visit the United Kingdom, Europe, and America to study tramway practice. Mr. T. W. Bridger has been appointed consulting electrical engineer to the Brisbane Water and Sewerage Board. Mr. A. G. Stephens, formerly manager of the Brisbane Tramways Co., has been elected to a seat on the Tramway Trust that has taken over the system.

Mr. Vincent Wodehouse Yorke, chairman of the Mexican Railway, who was injured in the accident that occurred on that railway, is a director of Whitehall Electric Investments.

Mr. W. E. Halfpenny, superintendent (lower grade) has been appointed assistant controller at the Central Telegraph Office, and Mr. E. J. Martin, assistant superintendent, becomes superintendent (lower grade).

Professor Magnus Maclean will vacate the chair of electrical engineering at the Glasgow Technical College on July 31st. The Professor, who retires under the superannuation scheme, has occupied the chair since June, 1899. Applications for the post (£1,000 per annum) are to be lodged by March 22nd.

Mr. C. G. Tegetmeier, chairman of the Tramways and Light Railways Association, has been appointed to represent the Association on the Land Transport (Railways, Tramways, and Carriage Building) Committee of the British Empire Exhibition, 1924.

East Grinstead Urban District Council has appointed Mr. A. S. Hooppell, late senior assistant electrical engineer to the Torquay Corporation, clerk of works in connection with the Council's electricity scheme.

Mr. W. J. Leeming, previously electrical engineer to the Buxton U.D.C., and who during the last year has been connected with Messrs. Prangnell Partners, Newcastle-on-Tyne, has now been appointed engineer at Stowe College, the new public school, Buckingham.

Obituary.—Mr. T. Clayton.—We regret to learn that Mr. Thomas Clayton, for 25 years with Messrs. W. Mackie & Co. (latterly as installations manager) passed away last week in St. Thomas's Hospital after a painful illness. The burial took place at Hammersmith Cemetery on Saturday, February 24th, following a service at St. Paul's Church, Hammersmith. Mr. Clayton was 49 years of age, and was well-known in electrical, masonic, and other circles; he was a baritone singer of great merit. He leaves a widow and daughter.

Mr. A. Martin.—*The Times* records the death of Mr. Arthur Martin, late inspector of telephone and telegraph traffic at the London headquarters, who retired in 1918.

Mr. George Rigby.—The death took place on February 21st of Mr. George Rigby, electrical engineer, of Wigan. He was 44 years of age, and was a director of Heyes & Co., Ltd., electrical engineers, of Wigan.

Mr. J. A. D. Bornemann.—We regret to record the death of Mr. J. A. D. Bornemann, C.B.E., J.P., who was for 23 years managing director of Ruston & Hornsby, Ltd., of Lincoln.

NEW COMPANIES REGISTERED.

International Radio Manufacturers, Ltd. (187,867).—Private company. Registered February 16th. Capital, £5,000 in 30,000 preference shares of 2s. 6d. each and 50,000 ordinary shares of 6d. each. To carry on the business of radio and electrical engineers and manufacturers, makers of, and dealers in all kinds of electrical apparatus, machines, accessories and goods, &c. The permanent joint managing directors are:—L. R. Osborn, 57, Buckingham Road, South Woodford, E.18; T. Hutchings, 6, The Parade, Aldersbrook Road, E.12. Qualification of permanent directors, 1,000 shares. Remuneration of managing directors, as fixed by the board; of directors, £100 per annum. Registered office: 119, High Street, Merton, Surrey.

Saxby & Farmer, Ltd. (187,860).—Registered on February 16th, at Somerset House, as a private company, with a nominal capital of £100 in £1 shares. The objects are:—To carry on the business of manufacturers of railway signals, locking apparatus, and safety appliances, mechanical engineers, and electricians, &c. The subscribers (each with one share) are:—H. G. Brown, 82, York Road, N.1, electrical engineer; R. Payne, 82, York Road, N.1, chartered secretary; B. H. Peter, 82, York Road, N.1, engineer. The subscribers are to appoint the first directors. No share qualification required. The registered office is at 82, York Road, King's Cross, N.1.

Central Electrical Engineers' Accessories Supply, Ltd. (188,006).—Private company. Registered February 22nd. Capital, £100 in £1 shares. To carry on the business indicated by the title. The first directors are:—S. Cohen, 479, Mile End Road, E.; N. Ettinger, 49, Mile End Road, E. Qualification, 15 shares. Registered office: 190, Bishopsgate Street, E.C.

Lenthall Gramophones, Ltd. (187,904).—Private company. Registered February 19th. Capital, £7,000 in £1 shares. To take over the business of a manufacturer of and dealer in the Lenthall sound box and gramophone and gramophone parts carried on by C. B. Lenthall at 51, Fountain Street, Manchester, and all or any of the contracts, assets and liabilities connected therewith; together with certain patents, specifications and designs (1) for improvements in and relating to diaphragms for acoustic instruments or apparatus, (2) for improvements in or relating to sound boxes for gramophones and like acoustic instruments or apparatus, (3) for a vibratory diaphragm (made of metal) for gramophones and other acoustic apparatus, and (4) for a vibratory diaphragm (made of mica celluloid or other solid substance); and to carry on the business of manufacturers of sound boxes, diaphragms for gramophones, wireless telegraphy, telephones, motor horns, &c. The first directors are:—C. B. Lenthall, 42, Cambridge Road, Southport; W. Lenthall, "Overlaw," Lightwood Road, Buxton. C. B. Lenthall is permanent managing director and chairman subject to holding 2,000 shares. Registered office: 51, Fountain Street, Manchester.

Robson, Paling & Co., Ltd. (187,994).—Private company. Registered February 21st. Capital, £2,000 in £1 shares. To acquire the business of electrical engineers carried on by H. Robson, trading as "H. Robson & Co." at 16a, Oxford Road, Manchester, and the business of scenic artists carried on by H. Robson and C. A. Paling as "C. A. Paling & Co." at 16, Oxford Road, Manchester, and to carry on the business of electricians, electrical and general engineers, scenic artists and contractors, designers and constructors of scenery and properties for theatre stages, kinema halls, trade halls, shows, exhibitions, &c. The first directors are:—H. Robson, 16a, Oxford Road, Manchester, electrical engineer; C. A. Paling, 53, Rumford Street, Manchester, scenic artist. Qualification: £1. Registered office: 16a, Oxford Road, Manchester.

Condor Lamps (Great Britain), Ltd. (187,970).—Private company. Registered February 21st. Capital, £2,500 in £1 shares. To carry on the business of electricians, electrical engineers, manufacturers of, agents for, and dealers in electric lamps, including metal filament, arc and half-watt lamps, dynamos, electroliers, &c. The first directors are:—A. C. Peebles, 10, Lennox Street, Edinburgh; R. Shaw, 7, Summerside Place, Bonnington, Edinburgh; J. E. H. Rieter, Keltenstraa, 14, Venlo, Holland; T. J. Van Lohwizen, Keltenstraat 14, Venlo, Holland; J. Braun, Kaldenkerkerweg 31, Venlo, Holland. Qualification: 1 share. Registered office: 60, Wilson Street, Finsbury Square, E.C.

Electric Home Cleaning Service Co., Ltd. (187,768).—Registered as a private company on February 13th, with a nominal capital of £1,000 in £1 shares. Objects: To carry on the business of cleaners of offices and other buildings, dealers in and repairers of vacuum and other cleaning apparatus, repairers and restorers of furniture, fittings and fabrics, &c., and to train and employ, so far as practicable, men who served in H.M. forces and their dependents. The first directors are: Mrs. E. M. Wood, 4, Park Village East, Regent's Park, N.W. (director of Samson, Clark & Co., Ltd.); Sir Malcolm N. Hogg, 39, Eaton Place, S.W.1 (director of Forbes, Forbes, Campbell & Co. and the Westminster Bank, Ltd.); F. W. Goodenough, 1, Young Street, Kensington, W., controller of gas sales, Gas Light and Coke Co.). Qualification: £5. Remuneration as fixed by the company. A co-operative scheme is contemplated, under which not more than a quarter of the profits, after providing for reserves, may be distributed among the workpeople. Secretary: Miss Hilda M. Garland. The registered office is at 57, Mortimer Street, W.1.

Stevenage Electric Light and Power Co., Ltd. (188,000).—Private company. Registered February 21st. Capital, £12,000 in £100 shares. To carry on the business indicated by the title. The permanent directors are:—A. W. Redford, 2, Essex Road, Stevenage; E. H. Taylor, Digswell House, Shefford, Beds. The said E. H. Taylor signs as joint managing director. Qualification: £500 shares. Solicitors: W. Times, Stevenage.

International Exaphone Co., Ltd. (187,935).—Private company. Registered February 20th. Capital, £1,000 in £1 shares. To acquire and take over all letters patent, rights and protections granted or to be granted to F. W. Hampshire in respect of exaphones, and to carry on the business of importers, exporters, and manufacturers of, agents for, and dealers in electrical instruments, wireless, telephonic and telegraphic apparatus, exaphones, gramophones, gramophone and phonograph records, indicators, fire alarms, lightning conductors, bells, signals, automatic time recorders, clocks, time switches, switchboards, flashers, controls, &c. The permanent directors are:—F. W. Hampshire (permanent governing director), Westwood Station Road, Mickleover, Derbyshire; Mrs. Elizabeth H. Hampshire, Westwood Station Road, Mickleover, Derbyshire. Qualification: £100. Registered office: 24, The Strand, Derby.

Prince's Electrical Clocks, Ltd. (187,910).—Private company. Registered February 19th. Capital, £3,000 in £1 shares. To carry on the business of manufacturers of and wholesale and retail vendors of electric clocks, clock and watch makers, chronometer manufacturers, makers of scientific instruments, and electric appliances, camera manufacturers and photographers, box and packing case makers, &c. The first directors are:—C. Beddington, 26, Seymour Street, W.1 (director of Poole's Vacuum Preserving Jars, Ltd.); C. E. Prince, Stubbins Manor, Birchett Green, near Maidenhead; G. E. C. Cochrane, 39, Egerton Terrace, S.W.3; R. H. S. Waley, 14, Seymour Street, W.1. (director of Vizier Cigarette Co., Ltd., and Eastern Tobacco Co., Ltd.). Secretary: D. R. Brodie. Registered office: 173, New Bond Street, W.

Colombian Power and Transport Co. (187,872).—Registered as a public company on February 17th, with a nominal capital of £50,000 in 1,000,000 shares of 1s. each. The objects are: To adopt an agreement with the Transport and Utility Trust, Ltd., for the assignment of the benefit of certain reports, investigations and resulting negotiations regarding prospective concessions and development schemes for the construction of tramways, waterworks, sewage and telephone systems, and the benefit of negotiations for the purchase of platinum and emerald mining rights, and for the purchase of prospective petroleum lands, &c. The purchase consideration is £41,700 (£16,700 cash and £25,000 debentures). The "Trust" has underwritten the issue of 666,000 shares for a commission of 10 per cent. payable in cash. The first directors are:—H. L. Galway, 95, Queen's Gate, S.W.7; W. B. Milford, 2, Kiddapore Avenue, Hampstead, N.W. Minimum cash subscription, £1,000. Qualification: 5,000 shares. Remuneration (except managing director) as fixed by the company. Secretary: F. Milton. The registered office is at 31, St. Swithin's Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cape Electric Tramways, Ltd. (54,636).—Return dated December 20th, 1922. Capital, £500,000 in £1 shares. 491,222 shares taken up. £91,222 paid. £400,000 considered as paid. Mortgages and charges, £205,500.

Falk, Stadelmann & Co., Ltd. (23,743).—Return dated January 12th, 1923. Capital, £650,000 in 365,000 pref. and 285,000 ord. shares of £1 each. 351,238 pref. and 268,317 ord. shares taken up. £1 per share called up on 185,800 pref. and 63,016 ord. shares. £248,816 paid. £370,739 considered as paid. Mortgages and charges, nil.

Ferranti, Ltd. (83,718).—Return dated December 28th, 1922. Capital, £130,000 in 60,000 pref., 60,000 ord., and 10,000 deferred shares of £1 each. 53,374 pref., 60,000 ord., and 10,000 deferred shares taken up. £123,374 considered as paid. Mortgages and charges, £59,369.

Hampshire Light Railways (Electric) Co., Ltd. (52,564).—Return dated January 13th, 1923. Capital, £1,000 in £10 shares. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Sun Electrical Co., Ltd. (63,261).—Return dated January 25th, 1923. Capital, £100,000 in 50,000 ord., 20,000 pref., and 300,000 pref. ord. shares of £1 each. 23,296 ord., 17,141, pref., and 13,735 pref. ord. shares taken up. £54,173 paid. Mortgages and charges, £1,125.

Hewittic Electric Co., Ltd. (89,947) (formerly the Westinghouse Cooper Hewitt Co., Ltd.).—Return dated December 27th, 1922. Capital, £30,000 in £1 shares. All shares taken up. £30,000 paid. Mortgages and charges nil.

Hall Telephone Accessories, Ltd.—Satisfaction in full on February 9th, 1923, of charge dated May 4th, 1922, securing £400.

Siemens Brothers & Co., Ltd.—Satisfaction to the extent of £25,600 on January 1st, 1923, of debenture stock dated January 15th, 1918, securing £1,330,000.

New British Electric Supply Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital, dated February 5th, 1923, to secure all moneys not exceeding £26,000, payable in respect of a guarantee given to Barclay's Bank of the account of Berkeley & Young, Ltd.

Berkeley & Young, Ltd.—Mortgage debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 5th, 1923, to secure all moneys due or to become due from company to Barclay's Bank, Ltd., 54, Lombard Street, E.C.

Whitstable Electric Co., Ltd.—Issue on February 10th, 1923, of £1,490 debentures, part of a series already registered.

Chippenham Electric Supply Co., Ltd.—Particulars filed of £5,000 debentures authorised September 29th, 1922, and covered by trust deed dated January 29th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,100. Trustees: Major A. Cotes, J.P., Chippenham; and H. St. G. Rawlins, Cirencester.

Electric Welders (Leeds), Ltd.—Debenture dated February 14th, 1923, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. M. Wilson, 22, Thornfield Road, West Park, Leeds.

CITY NOTES.

Woking Electric Supply Co., Ltd.

The balance on the year's working is £22,559, plus £1,222 brought forward. Debenture interest required £2,888; loan interest £494; dividend on 6 per cent. cum. pref. shares, £3,000; dividend on 7 per cent. "B" cum. pref. shares, £436; 10 per cent. on "C" cum. pref. shares, £1,050; income tax, £146; depreciation and renewals fund, £8,000; reserve, £4,000; dividend of 9 per cent. on the ordinary shares, £2,450; carried forward, £1,517. The number of consumers increased from 2,587 to 2,734; lamps connected from 190,610 to 222,590; and revenue from £44,219 to £47,562.

Italian Companies.

The following Italian companies have increased their capital:—Società Anonima Italiana Luce e Magneti (Turin), from 500,000 to 2,000,000 lire; Officine Elettriche dell'Isonzo (Trieste), from 1,500,000 to 3,000,000 lire; Società Telefonica delle Puglie (Bari), from 200,000 to 500,000 lire; Società Ligure Pugliese per l'Esercizio Imprese Elettriche di Genova, from 200,000 to 2,000,000 lire; Società Anonima del Gaz e Elettricità di Erba Incino, from 900,000 to 2,000,000 lire; Società Anglo-Romano per Illuminazione di Roma, from 50,000,000 to 75,000,000 lire; and the Società del Vino, an addition of 100,000 lire by the issue of 6 per cent. bonds.

The Società Elettrica Interprovinciale di Verona has increased its capital from 10,500,000 to 12,000,000 lire, following upon the incorporation of the Società per l'Industria Elettrica di Arzignano.

The Società Idroelettrica Piemonte (Turin) has decided upon an increase of its capital from 40,000,000 to 100,000,000 lire in two stages—to 80,000,000 up to December 31st, 1923; the balance afterwards.

Midland Counties Electric Supply Co.

According to the financial papers, the net profits of the undertakings operated and owned by this company amounted during 1922 to £107,730. £11,500 was placed to reserve, and £96,158 was received by the company as interest, dividends, &c. The balance at the credit of the profit and loss account, including £2,440 brought in, is £93,689. Loan and debenture interest took £35,749, reserve for debenture redemption £11,000, and general reserve £15,000, leaving £31,660. A dividend is proposed of 5 per cent. for the year, less tax, carrying forward £4,007.

It has become necessary to increase the share capital and extend the company's borrowing powers. This is in order to deal with current commitments, including the purchase of Spondon station, and to provide funds for the development pending in the company's undertakings. It is proposed to increase the capital from £1,000,000, divided into 1,000,000 shares of £1 each, to £2,000,000, divided into 2,000,000 shares of £1 each.

French Company.

Compagnie Française Thomson-Houston.—An extraordinary meeting of this company has just decided that its present capital of 200,000,000 fr. shall be increased by the issue of a further 100,000,000 fr., in one or more operations, at the discretion of the board, preference in subscription being reserved to existing shareholders. The new capital is needed for the completion of the orders already secured or anticipated in connection with the electrification of the railways. One contract in particular has already been signed with the Orleans Co. for the equipment of the Paris to Vierzon line. The company also expects to secure contracts from the extension of the French telephone network. It is a matter of common knowledge that the company has already had a share in the installation of automatic networks at Nice, Orleans, and quite lately in the Duchy of Luxemburg. The report adds that, without anticipating the accounts of the current year, the business already effected will justify the maintenance of last year's dividend of 9 per cent. Figures available show that the orders on the books totalled 222 millions and a half on December 31st, 1922, against 140 millions at the same period of 1921.

London Electric Supply Corporation, Ltd.

The annual meeting was held on February 23rd. Mr. Robert. H. Benson, who presided, drew attention to the fact that, although the gross revenue had fallen from £393,674 to £374,092, the gross profit had increased from £102,286 to £150,199, owing to a considerable reduction in working costs. The cost of production fell from 1.47d. to 1.08d. per kWh.

He believed that the general situation with regard to the problem of London's electricity supply had changed for the better, both financially and politically. The London companies hoped that they would be granted a long extension of tenure under some satisfactory arrangement, enabling the companies to place the generation of electricity under one control, with power to link up existing stations and construct new ones, combining forces with the municipal undertakings. The unique position and possibilities of the company's Deptford station would make it one of the principal stations in any scheme for the unification of London's electricity supply in the future. The directors had been successful in securing a 50-years' contract for the supply of the whole of the energy required by the South-Eastern section of the Southern Railway. This contract, when completed, would mean an additional output of between 80,000,000 and 100,000,000 kWh yearly. An option had been secured on land adjacent to the Deptford station some time previously; this had now been exercised, and negotiations for the purchase of the land were proceeding. There was ample space for installing the necessary plant to give more than double the supply required by the railway company. The contract was not easily obtained, and great credit was due to Mr. Partridge, who had conducted the long negotiations which preceded the success. A contract of this magnitude afforded an opportunity of making considerable improvements, and it was the directors' ambition to make their station the most economical in the London area. For such a large contract it would be necessary to raise more capital, and an agreement had been concluded with the Treasury under the Trade Facilities Act, 1921, by which the State would guarantee the repayment of capital to be raised by the company, and the interest thereon, for an amount representing the greater part of the moneys needed to carry out the contract. With this guarantee the company was sure to be able to raise the required capital on satisfactory terms.

The report and accounts were adopted, and at a subsequent extraordinary general meeting a resolution was unanimously passed approving the companies' Bill pending in Parliament dealing with the supply of electricity in London.

Liverpool Overhead Railway Co.

The gross revenue receipts for 1922 were £137,835, and the working expenses, including reserve appropriation were £133,449. The passengers carried were 11,719,762 against 13,389,857. Mr. G. D. Killey has been appointed chairman in the place of the late Mr. H. C. Woodward, and Mr. F. C. Bowring has been appointed a director. The surplus on the year's working was £4,386, but as interest on debenture stock required £6,755, the deficiency was £2,370. There was, however, £10,301 receivable under Section 11 of the Railways Act, 1921, and the balance brought forward was £5,577, so that there is available for dividend £13,508. A further £14,280, compensation payable under the Railways Act, 1921, has been received, and the directors have again found it necessary to transfer a proportion of this sum to revenue to pay the dividend on the preference shares. The amount so appropriated is £10,301. The directors could not see their way to declare an interim dividend, but they now recommend the declaration of a dividend for the year 1922 at the rate of 5 per cent. on the preference shares, leaving £5,577 to be carried forward.

Mersey Railway Co.

At the annual meeting on February 22nd, the Chairman (Mr. James Falconer) said that for the first time in the history of the company they were able to show a return on a part of the capital invested. The policy of the board of adopting electric traction in 1900 had been justified by steady progress. The traffic had considerably increased, and one way of permitting of a more frequent service of trains had been the gradual institution of automatic signalling similar to that employed on the London Underground railways. When this was completed it was hoped to be able to deal with 35 trains per hour instead of 20 as before.

Tyneside Tramways and Tramroads Co.

The directors' report for the half-year ended December 21st, 1922, states that the surplus of receipts over expenditure is £3,929, which, with a balance brought forward, makes £4,057 to the credit of profit and loss account. After the deduction of interest on mortgages, loans, &c., amounting to £1,942, a balance of £2,115 remains. The directors propose to allocate this as follows:—Dividend at the rate of 5 per cent. per annum (less tax) on the preference shares, £601; dividend at the rate of 2 per cent. per annum (less tax) on the ordinary shares, £1,339; and the balance of £175 will be carried forward. The traffic receipts show a decrease of £6,212 as compared with the last half of 1921, and for the whole year there is a decrease of £16,122. The decrease is accounted for by the depressed state of the shipbuilding and engineering industries in the area. Notwithstanding a considerable decrease in working expenses, the gross profit is £1,694 below that of 1921. The number of passengers carried decreased from 9,352,232 to 7,266,769, and the car-mileage from 614,307 to 522,743.

Yorkshire Electric Power Co.

Mr. Arnold G. Lupton (chairman) presided at the annual meeting on February 20th. In presenting the report and accounts, which were reviewed in our issue of February 16th, the chairman referred to the Act recently passed authorising an increase of capital and the conversion of the capital into £1 shares. He said that it was satisfactory to note that the three classes of the company's security stood at above par on the market. The company was supplying over a large part of the area, and the increased demands were an index of trade improvement. There had been a large decrease in costs, owing to substantial reductions in the price of coal, the use of larger and more efficient plant, and increased output. The completion of the new 12,500-kW generator at Thornhill should bring about still further economies. The company had spent over £2,000,000 and had 506 miles of mains, and 208 sub-stations. Supply was available in 90 districts, and the cables were being carried into the new Doncaster coalfield. Agreements were now in existence with 42 of the 55 undertakings at work in the area,

the latest being those with Leeds, Rotherham, Holmfirth, and Mexborough. The construction of the large station at Ferrybridge had been delayed, but the company hoped for an early decision to enable it to provide the much-needed work for the unemployed. Their experience had proved that the concentration of plant in large stations showed a great advantage over the operations of small isolated stations, and many authorities who were now taking a bulk supply from the company were in a far better financial position. Many were anxious to know when the new capital would be required, but it was not easy to reply. The board would, however, follow the same conservative policy as hitherto, but the great increase in demands would soon necessitate the raising of more money.

The report and accounts were adopted, and the retiring directors re-elected.

Metropolitan Electric Supply Co., Ltd.

The report states that the capital expended during 1922 was £258,591. The gross revenue was £557,087, an increase of of £18,616. Working expenses totalled £263,903, a decrease of £65,338. £120,000 has been put to depreciation and reserve, making £780,000. An examination of the accounts has shown that, from the incorporation of the company to December 31st, 1922, the cost of plant, machinery, foundations, &c., which have been displaced or sold, after crediting the proceeds of sale, is approximately £280,000. It has been decided that the capital account should be reduced by this amount and the depreciation and reserve account has been adjusted accordingly. After this has been done the balance at credit of the latter account is £500,000. The amount carried to the credit of net revenue account is £173,184, plus the balance brought forward and interest and dividends on investments and allied electric undertakings, making a total of £212,350. After deducting interest on debenture stocks and loans, dividend on preference shares and sinking fund appropriations, £91,758 remains. The total distribution for the year on the ordinary shares is 8¼ per cent., leaving £6,758 to be carried forward. New connections, representing 3,335 kW, were added, making the total 56,412 kW. The 20,000-kW plant is now practically completed, and the machines have been put on load. The trunk mains from Willesden to Uxbridge are completed and in use. Captain Rendell, who acted as general manager for six years, retired at his own request in September, and Major H. Richardson has been appointed as his successor. The report contains brief reference to the unsatisfactory London proposals of the Electricity Commissioners and to the companies' scheme. Meeting, March 6th.

Electrical Distribution of Yorkshire, Ltd.

The net profit for 1922 was £14,419, against £8,086 in 1922. £2,724 was brought forward. A dividend of 7 per cent., free of income tax, requires £8,819; £4,000 is being put to reserve; £258 written off furniture, electrical appliances, &c.; and £4,066 is to be carried forward. There was a large addition to the number of consumers, and important extensions of mains have been made. The Electric Lighting Provisional Order granted in 1912 to the Urban District Council of Hoyland Nether has been acquired by transfer, and the company has been authorised to commence supply under the Orders for Selby and District, Stanley, Featherstone, Garforth, Horbury, Otley, Penistone and Rawdon. The applications made by the Company for powers to supply electricity in other districts in the West Riding are still awaiting the decision of the Electricity Commissioners. In anticipation of the additional capital requirements for the development of these new undertakings, the shareholders will be asked to authorise an increase in the nominal capital.

Underground Electric Railway Companies.

For the first time a single meeting of the companies forming the London "Underground" group was held, instead of individual meetings as in previous years. This took place on February 22nd, Lord Ashfield, chairman and managing director, presiding.

In moving the adoption of the report and accounts (*vide* our last issue), the chairman said that although there had been a decline in the number of passengers carried by the railways, the omnibus traffic had increased to a great extent. Gross receipts had fallen from £12,287,000 in 1921 to £12,028,000 last year, but at the same time expenses had decreased from £10,426,000 to £9,943,000 in spite of augmented services. Wages showed a decrease of 8 per cent., power supplies, 37 per cent., and other materials and supplies, 11 per cent. Although the railway operating costs were still 172 per cent. above the pre-war standard, fares had only advanced by about 70 per cent. Fares had been reduced in an endeavour to revive traffic, but even last year a reasonable return upon the capital invested had hardly been assured. The real hope for the maintenance of the prosperity of the undertakings lay in the growth of traffic, and the number of passengers was already increasing. If the normal annual growth could be resumed there was no doubt that the present financial position could be maintained and gradually bettered. It had been the policy of the boards to hold the balance evenly between reserves and dividends, and now that the income was larger this policy should operate so as to improve the reserve position; accordingly, the gains had been shared as equally as possible between the two. The distribution upon the ordinary dividends was the best in the history of the group, and the carry-forward had been increased.

The directors had come to the conclusion that the forward policy was again the right policy for the Underground Railways; the sure way of building up and retaining traffics for the railways was a policy of extension into those parts of London awaiting housing development. The aid proffered by the Trade Facilities Act rendered it possible to consider the execution of certain works which otherwise would have remained in abeyance for some time. Consequently powers already obtained but in abeyance were augmented by the passage of new Acts, and agreements were entered into with the Government by which issues of £3,250,000 of 4½ per cent. redeemable second debenture stock in the case of the London Electric Railway, and £2,750,000 of similar stock in the case of the City and South London Railway were guaranteed as to principal and interest by the Government. Certain balances of debenture stock amounting to £458,000, which the Central London Railway had still unissued, were to be devoted to the improvement of some of the more important stations on the systems.

The programme of new works was being pushed forward rapidly. It was expected that through trains would be running from Moorgate to Hendon by October of this year, and that the portion between Hendon and Edgware would be completed by the close of the year. It was hoped to have the whole programme finished by the end of next year. The schemes had relieved unemployment to a considerable extent. The completion of these schemes would not put an end to the companies' activities, however. Another programme had been prepared, and this was embodied in three Bills now before Parliament; an expenditure of £8,000,000 was involved. Lord Ashfield believed that London would continue to be the most important metropolis in the world, and he believed in making timely provision for its expansion.

Referring to the advent of competitive omnibus concerns, the chairman said that he was no believer in competition in urban transport, but equally he was no believer in a protected monopoly. If the older concerns gave fair terms there was no merit in new ventures. The companies had spent large sums in the development of transport facilities, but he agreed that a responsible and judicial authority was required to develop the system stage by stage, either by means of the existing undertakers, or by calling in those who were willing to enter as they were needed. He condemned competition on a number of grounds, but asserted the ability of the companies to meet it, although he regretted that their resources should have to be used in this way instead of in making further improvements.

W. T. Henley's Telegraph Works Co., Ltd.

The report shows a profit of £249,352 for the year 1922. After deducting directors' and auditors' fees, debenture interest, and the amount written off for depreciation. £43,012, adding £260,244 brought forward and £7,526 profit on realisation of investments, there is a total of £474,108. Income tax is £18,620; £25,000 is put to reserve; preference dividend, £9,000; 3s. per share on the ordinary shares requires £97,500, leaving £323,988 to be carried forward. Provision has been made in the accounts in respect of liability for Corporation Profits Tax to the end of 1922. Henley's Tyre and Rubber Co., Ltd., has had an improved year's trading, but the condition of the tire trade remains very unsatisfactory to British manufacturers. Mr. A. A. Campbell Swinton, F.R.S., has joined the board. Meeting: March 2nd.

Metropolitan Railway Co.

The annual meeting of the company was held on February 22nd. Lord Aberconway (chairman), who presided, pointed out that the total of the company's depreciation and reserve funds now stood at over £1,000,000, as compared with £166,000 in 1913, representing 5 per cent of the capital of the company as against 1 per cent. The company's total receipts in 1922 were £2,237,281, almost double those of 1913. The total expenditure at £1,946,532, including fixed charges, debenture interest, and preference dividends, represented an advance of 88½ per cent. upon the 1913 total. At the same time it should be pointed out that, dealing with traffic receipts and expenses only, the ratio of costs to receipts had risen from 57 per cent. to 71 per cent. This was principally due to increased wages, and although he had no doubt that the wages paid in pre-war days were in many instances too low, he was not sure that they were not paying too much to-day. At any rate, there were many irksome restrictions imposed on railway companies in the last settlement with the unions, which should be withdrawn.

The reduction of fares in January had caused a fall in receipts, but he was hopeful that as these reductions became better known an increase in traffic would occur. Although the traffic was undoubtedly affected by trade conditions during 1922, the company had been able to make considerable savings in expenditure owing to lower coal prices, &c.

The work of improving and rebuilding stations was proceeding, and there were many other developments in hand which would result in additional business. In conclusion, the chairman said that, having regard to the depressed state of trade during the year under review, he thought the results had been very satisfactory. The policy of the company was to build up reserves out of revenue, which made their financial position secure and enabled them to keep their capital account at a reasonably low figure. He considered that they had every reason to be hopeful as to the future of the undertaking.

London United Tramways, Ltd.—The net income for 1922 was £126,978. Deducting interest and payments to local authorities, £58,326, the surplus was £68,652, of which £11,408 has been applied in writing off the deficiency at December 31st, 1921, leaving £57,244 carried to credit of reserve for reconstruction and renewals. The surplus of £59,474 in 1921 reduced the deficiency of £70,882 at December, 1920, to £11,408. The *Financial Times* says that the report states that under the London United Tramways Act, 1918, until the company has expended in reconstruction, or has set aside for that purpose £400,000, the company shall not pay any dividend upon the preference or ordinary shares. As shown in the balance-sheet, £286,645 has been expended, and this amount will be substantially increased during the present year.

Metropolitan Electric Tramways Co., Ltd.—The net income for 1922, including dividend from North Metropolitan Electric Power Supply Co., £35,002, was £313,419, plus balance brought in, making £315,839. Deducting interest and rentals, £143,079, provision for reconstruction and renewals, £99,169, and appropriation to reserve, £13,659, the balance available was £59,932. According to the *Financial Times*, the directors propose a dividend on the 5 per cent. cumulative preference shares, being a balance of 2½ per cent. in respect of 1920, 5 per cent. for 1921, and 4 per cent. on account of 1922, leaving to be carried forward £2,432.

North Metropolitan Electric Power Supply Co.—The net revenue for 1922 (says a financial contemporary) totalled £168,058, compared with £125,332 for 1921. Adding interest and dividends received and £5,006 brought forward makes £177,851. Deducting mortgage, debenture stock, and other interest, £30,472, reserve fund for 5 per cent. mortgages, £2,000, redemption fund for 7½ per cent. debenture stock, £2,370, contribution to reserve, £50,000, leaves £93,008. Dividend on the ordinary shares at rate of 10 per cent. per annum, carrying forward £7,073.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—Net receipts for 1922, £51,933, making, with the balance brought in, £54,797. Interest and fixed charges were £8,299, provision for reconstruction and renewals, £18,500, and appropriation to reserve, £1,000. Dividend on the ordinary shares at the rate of 7½ per cent. per annum, carrying forward £3,235.

City of London Electric Lighting Co., Ltd.—A dividend of 2s. per share is recommended, making 15 per cent. for the year, compared with 14 per cent. for 1921. £130,000 (against £85,000) is put to reserve.

Harrow Electric Light and Power Co., Ltd.—After deducting debenture interest and the interim dividend on the preference shares, a balance of £4,762 remained. It was proposed to pay the final dividend on the preference shares, £375; to pay a dividend at the rate of 8 per cent. per annum on the ordinary shares, £2,667; to place £1,000 to reserve; and carry the balance forward.

Fife Tramways, Light & Power Co.—Net profits for the past year were £93,688. Of this, £11,500 was appropriated to reserve, and after paying other expenses there remained £77,138, including £4,357 brought forward. To loan interest and interest on debentures was placed £21,088, £11,493 to dividend on preference shares, and £14,883 to reserves, leaving £29,672. Dividend recommended of 8 per cent., less tax, carrying forward £2,551.

National Gas Engine Co., Ltd.—Net profit for 1922, after providing for depreciation, management, salaries, Corporation Profits tax, and income tax, £28,658, plus £32,284 brought forward. 7½ per cent. interim dividend was paid on the ordinary shares, and a final dividend of 5 per cent. per annum, less tax, is recommended, leaving £11,442 to be carried forward.

Chas. Clifford & Son, Ltd.—The directors recommend a dividend at the rate of 10 per cent. per annum for the last half of 1922, plus a bonus of 5 per cent., both free of tax. £16,637 carried forward.

Aberdeen Suburban Tramways Co., Ltd.—For the half-year ended January, 1923, there was a profit of £1,371. Considerable sums have been spent on track repair and renewal.

Browett, Lindley & Co., Ltd.—It is proposed to increase the preference dividend rate of interest from 6 per cent. to 7 per cent. if holders relinquish the right to share in the surplus assets in the event of winding up.

Clyde Valley Electrical Power Co.—A dividend of 5½ per cent. actual on the ordinary shares is recommended, making 8 per cent. for the year.

Mansfield and District Tramways Co., Ltd.—Dividend of 6 per cent. on the ordinary shares, making 9 per cent. for the year, less tax, carrying forward £1,362.

Halifax and Bermudas Cable Co., Ltd.—Interim dividend of 6 per cent. per annum, free of tax, on the ordinary shares.

Direct West India Cable Co., Ltd.—Interim dividend of 10 per cent. per annum, free of tax, on the ordinary shares.

Scottish Power Co.—Dividend of 6 per cent. per annum, less tax, on the ordinary shares for the year 1922.

The Siemens-Schuckert Group.—A statement has been issued by the Siemens & Halske Co. showing gross profits of 212.44 millions of marks for 1921-22 as compared with 55.58 millions in the preceding year. After meeting general expenses, provision for depreciation, &c., the accounts represent net profits of 158.25 millions of marks, as against 37.1 millions in 1920-21. It is proposed to pay a dividend at the rate of 80 per cent. on the ordinary shares, contrasting with 20 per cent. in the previous year.

The gross profits of the Siemens-Schuckert Works Co. are returned at 220.94 millions of marks, as against 62.6 millions in 1920-21. Having made provision for general charges, depreciation, &c., the company reports net profits of 109.39 millions of marks as compared with 22.50 millions in 1920-21. The rate of dividend is increased from 16 per cent. to 80 per cent. in 1921-22.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

City of London Electric Lighting.—£100,000 4½ per cent. second debenture stock.

Pirelli-General Cable Works.—£300,000 6 per cent. first mortgage guaranteed debenture stock, fully paid.

Application has been made to the Committee to allow the following to be officially quoted:—

Pinchin Johnson & Co.—300,000 ordinary shares of £1 each, fully paid, Nos. 1 to 300,000; and 500,000 6½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 500,000.

The undermentioned securities have been ordered to be officially quoted:—

Central London Railway Co.—£458,000 4½ per cent. redeemable debenture stock, 1942-1972.

City and South London Railway Co.—£2,750,000 4½ per cent. redeemable second debenture stock, 1942-1972.

London Electric Railway Co.—£3,250,000 4½ per cent. redeemable second debenture stock, 1942-1972.

Manila Electric Corporation.—2,000,000 dols. common stock.

Smithfield Markets Electric Supply Co., Ltd.—The net profit for 1922, after providing for interest on debenture stock and other charges, putting £4,500 to depreciation fund and £2,000 to debenture stock redemption fund, is £8,900, plus £1,549 brought forward. A dividend of 6 per cent. on the ordinary shares requires £3,600, £2,000 is put to reserve, £3,000 to staff provident fund, and £1,849 is to be carried forward. A further reduction in costs, combined with a satisfactory increase in output, enabled the board to reduce the charge per kWh last July. The connected load has steadily increased. Meeting held March 1st.

Rushden and District Electric Supply Co., Ltd.—Addressing the annual meeting on February 23rd, Mr. F. H. Thornton said that the past year had been one of marking time while waiting for the confirmation of the Order for the Northampton Co. to supply them in bulk. That confirmation had now been obtained, and steps were being taken to commence the work. The Rushden Co. was inviting tenders for the necessary transforming plant, and it was hoped that it might be able to obtain supply before the end of the year. Considerable developments would follow. They had felt justified in increasing the dividend from 7½ per cent. to 8 per cent.

Northampton Electric Light and Power Co., Ltd.—Mr. F. H. Thornton presided at the annual meeting on February 23rd. The report was adopted.

Vickers, Ltd.—It is announced that the following final dividends for the half-year ended December 31st, 1922, will be paid to the holders of the preferred stock and preference shares: 2½ per cent. on the preferred five per cent. stock, less tax; 2½ per cent. on the five per cent. preference shares, less tax; 2½ per cent. on the cumulative preference shares, free of tax up to 6s. in the £.

Liverpool District Lighting Co., Ltd.—The liquidator announces (says the *Financial Times*) that the undertaking has been transferred to the Corporation of Liverpool, and that a return of the par value of the shares (£5) will be made on production of the share certificate and the official form of receipt. It is expected that a second and final return of a little over 11s. per share will be made.

Yorkshire (West Riding) Electric Tramways, Ltd.—After meeting debenture interest, providing for preference dividend, devoting £14,958 to purchase of funded preferential dividend certificates, and putting £23,537 to renewals, depreciation, and reserve fund in lieu of accident insurance, £4,222 remains to be carried forward.

Davis & Timmins, Ltd.—Net profit for 1922 of £12,861 (against a net loss of £12,850 for 1921). The directors recommend a distribution of 8 per cent. for the year, and a bonus of 17 per cent., both free of tax, carrying forward £30,682, subject to corporation profits tax.

Bruce Peebles & Co., Ltd.—Dividend on the ordinary shares of 10 per cent., less tax, also a bonus of 5 per cent., less tax.

Newcastle-upon-Tyne Electric Supply Co.—Dividend of 2½ per cent. on the ordinary shares for 1922.

STOCKS AND SHARES.

Tuesday Evening.

The extraordinary rise in electricity supply shares has been checked by the fact of there being so comparatively few in which to deal. The latest results are distinctly good, the Metropolitan paying 8½ per cent., and the County of London 10 per cent. For some reason or other, a vague rumour had got abroad to the effect that the County company might pay 12 per cent. for the year, and, on the 10 per cent. announcement being made, the shares gave way from the best. Proprietors, however, who realise the position of the County company, and appreciate the scope that there is for the extension of its work, will heartily endorse the action of their directors in refusing to divide up to the hilt profits which, in part, will be invaluable in the future for making more profits. South London shares had a dramatic rise in consequence of the increase in the dividend from 7 per cent. to 10 per cent. and a bonus of 1 per cent.

With nearly all the results to hand, we have been able to bring our tables of electricity supply stocks and shares, together with those of the railway companies, up to date, and it will be noticed that the results of 1921 and 1922 can now be compared in the lists which we give. In this connection it may be observed that last week's reference to Westminster Electric preference shares spoke of these as being 5½ per cents., whereas, of course, the actual rate of dividend is 4½ per cent., as everybody knows. For drawing attention to the mistake, thanks are due to a courteous correspondent.

As already observed, the changes in the price-lists are few, owing to the disinclination of proprietors to part with shares upon which they are receiving such fat dividends. Londons, at 4½, are unaffected by the important contract secured by the company for the supply of power for fifty years to part of the South Eastern, now the Southern Railway, system. South Londons put on 22s. 6d., rising to 6½, on the dramatic increase in the dividend. Charing Cross ordinary have achieved double figures, and St. James hardened to 10½. Urban ordinary and preference are both better. Newcastle-on-Tyne ordinary improved to 18s. 9d. Midland Counties ordinary remained at 17s., the proposal to double the capital being treated as a bull rather than as a bear point. Whitehall debenture keeps its rise at 92½; the preference gave way a trifle to 19s.

In the manufacturing division, General Electric preference at 22s. 3d. are sixpence down. Siemens put on 1s. 9d. to 21s. 3d., at which the shares seem fairly valued as things are at present. Metropolitan-Vickers preference strengthened to 2½, and British Insulated to the same price. Henley's are good at 2½. Net profits of £206,300 are about £18,000 down as compared with the previous year, but the financial position of the company is exceedingly strong, and the dividend on the ordinary, as already announced, is maintained at 15 per cent.

The strength of Underground Electrics stands out as one of the main features of the Home Railway market, the company's £10 shares having risen to 3½. The Income Bonds are also better at 98½, and the shilling shares show 1s. 6d. gain at 9s. Lord Ashfield, speaking the other day, referred to motor 'bus competition in a very sensible and businesslike manner; every Londoner will probably agree that to put another thousand 'buses on the streets of London at the present time would be a physical impossibility. London Suburban Traction preference, which have been somewhat heavy at about 11s. 9d., are better at 12s., and as the possibilities of these shares receiving their arrears of dividend are better realised, the price will go up to the neighbourhood of 15s. The shares are, of course, speculative, but a fair risk, having regard to the yield on the money.

Anglo-American Telegraphs are firmer; Eastern ordinary is a point lower, and West India and Panama went back 2s. 6d. to 5s., shares changing hands down to 4s. 6d. Marconi's rallied to 2 11/16 buyers. Canadian Marconis have failed to respond, so far, to the announcement that the company has been granted a licence by the Canadian Government for the operation of a station on Vancouver Island, with a nominal range of 7,000 miles. The price of the shares is 11s. 6d.

British Electric Traction ordinary is another 3 points up at 74½, an increase in the dividend being the motive of persistent buying pressure. The preference stock is 2 higher at 99. Anglo-Argentine Tramways 5 per cent. debenture is 3½ to the good, a movement that will please, it may be hoped, those investors who agreed with the previous argument that the stock looked cheap at anything like 75. The first preference are better at 3¾, still appearing a good speculative investment of their class. Mexican issues have small gains to their credit, and the new St. Maurice scrip strengthened to 4½ premium.

Rubber shares are steady but idle. The raw material fluctuates between 1s. 5d. and 1s. 6d. per lb. However, golf balls are reduced in price, which is something for which to be thankful. Armstrongs are a firm market; Vickers have drooped, and other shares in this particular section exhibit irregular changes on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend. 1921.	Dividend. 1922.	Price Feb. 27, 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	—	34/6†	—	£3 9 8
Charing Cross Ordinary	9	14	10	+ ½	7 0 0
do. do. do. 4½ Pref....	4½	4½	4⅞	—	5 7 5
Chelsea	6	10	9⅜	—	5 19 5
City of London	14	—	48/-	—	5 16 8
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	10	35/-	—	4 11 5
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Edmundson's Ordinary	Nil	—	2½	—	Nil
do 6 per cent. Pref.	12/-	—	4⅜	—	6 13 4
Kensington Ordinary	10	12	9	—	6 13 4
London Electric	4	10	4½	—	3 16 2
do. do. 6 per cent. Pref.	6	6	5⅛	—	5 17 1
Metropolitan	7	8½	7	— ¼	6 1 5
do. 4½ per cent. Pref.	4½	4½	4 15/16	—	5 10 9
Newcastle-on-Tyne Ordinary	Nil	—	1/2	+ 1/16	Nil
do 5 per cent. Pref.	5	5	15/9	—	6 7 0
do 7 per cent. Pref.	7	7	22/6	—	6 4 6
Notting Hill, 6 per cent. Pref.	6	6	9½	—	6 9 9
North Met. Elec., 6 per cent. Pref.	6	6	1 1/16	—	5 13 0
Urban Ordinary	Nil	—	1⅜	+ ⅛	Nil
do 5 per cent. Pref.	2½	—	4½	+ ⅛	5 17 8
St James' and Pall Mall	12	14½	10⅞	+ ¼	6 14 7
South London	7	10	6⅛	+ ⅛	7 6 2
South Metropolitan Pref.	7	7	1½	+ 1/16	5 12 0
Westminster Ordinary	10	12	9	—	5 11 1
Whitehall Elec. Inst., 7½ per cent. Pf.	7½	7½	19/-	—6d.	7 18 0

Home Rails.

Central London Ord. Assented	4	—	68xd	+ ⅜	5 17 8
Metropolitan	2½	3½	61½	—	5 13 10
do. District	1	3	52½	+ ½	5 16 6
Underground Electric Ordinary	Nil	Nil	3½	+ ⅛	Nil
do. do. "A"	Nil	Nil	2/-	+1/8	Nil
do. do. Income	4	5	98½	+ ½	*5 1 6

Telegraphs and Telephones.

	Dividend. 1920.	Dividend. 1921.			
Anglo-Am. Tel. Pref.	6	6	104	+ ½	5 15 5
do. Def.	1½	34/6	22⅜	+ ⅜	6 11 10
Chile Telephone	6	6	6⅛	—	4 16 0
Cuba Sub. Ord.	7	7	7⅛	— ⅛	9 6 8
Eastern Extension	10	10	19	—	5 5 3
Eastern Tel. Ord.	10	10	185½	—1	5 7 10
Globe Tel. and T. Ord.	10	10	19	—	5 5 3
do. do., Pref.	6	6	11⅛	—	5 7 10
Great Northern Tel.	24	22	27½	—	8 2 0
Indo-European	10	10	85½	—	7 1 0
Marconi	25	15	2 1/16	+ 1/16	5 11 6
Oriental Telephone Ord.	12	12	2 5/16	— 1/16	*4 13 5
United R. Plate Tel.	8	8	7⅛	+ ⅛	*5 6 8
West India and Panama	Nil	Nil	5/-	—2/6	Nil
Western Telegraph	10	10	18⅜	—	*5 6 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5½	12½	8⅜	+ 1/16	7 6 8
do. do. 2nd Pref.	Nil	5½	3⅜	—	8 5 6
do. do. 5 per cent. Deb.	5	5	85½	+3½	5 17 0
British Electric Traction Ordinary	4½	—	74½	+3	6 0
do 6 per cent. Pref.	6	6	99	+ 2	6 1 3
Brazil Tractions	Nil	Nil	52	+3	7 13 10
British Columbia Elec. Rly. Pcs.	5	5	81½	—	6 2 8
do. do. Preferred	5	93/-	76½	—	*6 2 6
do. do. Deferred	3	124/-	90½	—	*6 18 6
do. do. Deb.	4½	4½	77½	+1	5 9 8
Lond. and Sub. Trac., 5 per cent. Pf.	2½	3½	13/-	—	8 5 8
London United Tram deb.	4	4	69½	—	6 8 0
Mexico Tram. 5 per cent. Bonds	Nil	Nil	31½	—	8 2 8
do. 5 per cent. Bonds	Nil	Nil	60½	+1	Nil
Mexican Light Common	Nil	Nil	19½	—	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds.	Nil	5	85½	+1	7 12 6

Manufacturing Companies.

Babcock & Wilcox	15	16	3 11/16	—	4 6 9
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	2½	+ 1/16	8 0 0
Callenders	15	15	2 3/16	—	6 18 4
do. 6½ Pref....	6½	6½	1 1/16	—	5 9 5
Crompton Ord.	10	5	17/6	—	5 14 4
Edison-Swan	10	Nil	3/3	—	Nil.
do. do. 5 per cent. Deb.	5	5	61	—	8 1 4
Electric Construction	10	10	1⅜	—	7 5 6
English Electric	5	5	17/3	—	5 16 0
do. do. Pref.	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	6½	6½	22/3	—6d.	5 16 10
do. Ord.	10	5	19/3	—	5 4 0
Henley	15	15	2⅜	+ 1/16	6 6 4
do. 4½ Pref.	4½	4½	4½xd	—	5 6 0
India-Rubber	10	—	13/9	—	—
Met.-Vickers Pref.	5	5	2½	+ 1/16	6 8 0
Siemens Ord.	10	10	1 1/16	+1/9	Nil.
Telegraph Con.	20	20	36⅜	—	*4 11 6

* Dividends paid free of Income Tax.
† New shares.

ELECTRICAL IMPORTS AND EXPORTS OF JAPAN.

The following statement shows the import and export trade of Japan in 1921 in electrical and similar goods. For purposes of comparison, figures for 1920 have been added, together with a note of increases or decreases.

IMPORTS.

Country whence imported.	1920. Yen.	1921. Yen.	Inc. or dec. Yen.
Insulated electric wires.—			
Total	147,000	156,000	+ 9,000
United States	141,000	147,000	+ 6,000
United Kingdom	1,000	4,000	+ 3,000
Steam turbines.—			
Total	1,701,000	2,292,000	+ 591,000
United States	1,521,000	1,870,000	+ 349,000
United Kingdom	91,000	—	– 91,000
Germany	—	159,000	+ 159,000
Sweden	—	195,000	+ 195,000
Parts of steam turbines.—			
Total	741,000	824,000	+ 83,000
United Kingdom	278,000	183,000	– 95,000
Sweden	47,000	182,000	+ 135,000
United States	390,000	454,000	+ 64,000
Gas engines and internal combustion motors.—			
Total	4,771,000	1,111,000	–3,660,000
United Kingdom	3,254,000	199,000	–3,055,000
Sweden	44,000	32,000	– 12,000
United States	818,000	747,000	– 71,000
Germany	24,000	94,000	+ 70,000
Steam engines.—			
Total	491,000	391,000	– 100,000
United Kingdom	222,000	286,000	+ 64,000
United States	170,000	65,000	– 105,000
Belgium	—	38,000	+ 38,000
Italy	98,000	—	– 98,000
Steam boilers and parts.—			
Total	6,680,000	7,605,000	+ 925,000
Kwantung Province	1,000	5,000	+ 4,000
United Kingdom	2,929,000	5,117,000	+2,188,000
United States	3,358,000	2,226,000	–1,132,000
Dynamos, motors, transformers, &c.—			
Total	6,080,000	9,664,000	+3,584,000
France	17,000	21,000	+ 4,000
United Kingdom	376,000	758,000	+ 382,000
Sweden	97,000	206,000	+ 109,000
United States	5,485,000	8,047,000	+2,562,000
Switzerland	66,000	17,000	– 49,000
Germany	23,000	546,000	+ 523,000
Dynamos combined with motive machinery.—			
Total	684,000	640,000	– 44,000
United Kingdom	16,000	80,000	+ 64,000
United States	529,000	503,000	– 26,000
Italy	137,000	—	– 137,000
Switzerland	—	55,000	+ 55,000
Telegraph and telephone instruments and parts.—			
Total	586,000	882,000	+ 296,000
United Kingdom	22,000	28,000	+ 6,000
France	3,000	—	– 3,000
Denmark	5,000	3,000	– 2,000
United States	535,000	847,000	+ 312,000
Water turbines and Pelton wheels.—			
Total	779,000	1,600,000	+ 821,000
United Kingdom	—	374,000	+ 374,000
France	41,000	84,000	+ 43,000
Switzerland	91,000	554,000	+ 463,000
Sweden	134,000	465,000	+ 331,000
United States	460,000	102,000	– 358,000
Lamps, lanterns and parts.—			
Total	364,000	537,000	+ 173,000
United Kingdom	36,000	60,000	+ 24,000
United States	320,000	372,000	+ 52,000
Submarine telegraph or telephone cables.—			
Total (all from United Kingdom)	1,613,000	1,711,000	+ 98,000
Wattmeters.—			
Total	306,000	550,000	+ 244,000
United Kingdom	4,000	2,000	– 2,000
Germany	24,000	227,000	+ 203,000
United States	173,000	251,000	+ 78,000
France	93,000	62,000	– 31,000
Other meters.—			
Total	1,023,000	2,335,000	+1,312,000
United Kingdom	229,000	419,000	+ 190,000
United States	699,000	998,000	+ 299,000
Germany	34,000	852,000	+ 818,000
Carbon for electrical use.—			
Total	583,000	258,000	– 325,000
United Kingdom	25,000	41,000	+ 16,000
Germany	7,000	37,000	+ 30,000
United States	534,000	176,000	– 358,000

EXPORTS.

Country to which exported.	1920. Yen.	1921. Yen.	Inc. or dec. Yen.
Electrical machinery and parts thereof.—			
Total	5,211,000	3,084,000	–2,127,000
China	1,326,000	1,372,000	+ 46,000
Kwantung Province	1,468,000	942,000	– 526,000
Hong Kong	172,000	119,000	– 53,000
British India	52,000	22,000	– 30,000
Straits Settlements	338,000	134,000	– 204,000
Dutch India	10,000	—	– 10,000
French Indo-China	77,000	7,000	– 70,000
Asiatic Russia	44,000	26,000	– 18,000
Philippine Islands	10,000	8,000	– 2,000
Siam	530,000	110,000	– 420,000
United Kingdom	89,000	—	– 89,000
France	16,000	13,000	– 3,000
United States	30,000	4,000	– 26,000
Canada	11,000	—	– 11,000
Chile	47,000	22,000	– 25,000
Argentine	17,000	—	– 17,000
Egypt	11,000	6,000	– 5,000
Cape Colony and Natal	707,000	177,000	– 530,000
Australia	108,000	31,000	– 77,000
Telephones and parts thereof.—			
Total	641,000	118,000	– 523,000
China	112,000	37,000	– 75,000
Kwantung Province	277,000	76,000	– 201,000
Dutch India	1,000	—	– 1,000
Straits Settlements	1,000	1,000	—
Electric lamps.—			
Total	2,145,000	1,027,000	–1,118,000
China	293,000	139,000	– 154,000
Kwangtung Province	162,000	266,000	+ 104,000
Hong Kong	92,000	51,000	– 41,000
British India	33,000	13,000	– 20,000
Straits Settlements	7,000	2,000	– 5,000
Dutch India	14,000	5,000	– 9,000
French Indo-China	18,000	1,000	– 17,000
Asiatic Russia	10,000	2,000	– 8,000
Siam	16,000	13,000	– 3,000
United Kingdom	3,000	2,000	– 1,000
France	14,000	9,000	– 5,000
Italy	112,000	—	– 112,000
United States	951,000	362,000	– 589,000
Canada	263,000	89,000	– 174,000
Peru	22,000	2,000	– 20,000
Chile	27,000	1,000	– 26,000
Argentine	8,000	1,000	– 7,000
Egypt	14,000	1,000	– 13,000
Australia	9,000	2,000	– 7,000
Philippine Islands	50,000	49,000	– 1,000
Insulated electric wire.—			
Total	8,043,000	3,273,000	–4,770,000
China	3,863,000	1,518,000	–2,345,000
Kwantung Province	1,494,000	1,111,000	– 383,000
Hong Kong	149,000	129,000	– 20,000
British India	328,000	57,000	– 271,000
Straits Settlements	41,000	9,000	– 32,000
Dutch India	926,000	287,000	– 639,000
French Indo-China	77,000	2,000	– 75,000
Asiatic Russia	436,000	9,000	– 427,000
Philippine Islands	3,000	18,000	+ 15,000
Siam	117,000	41,000	– 76,000
United Kingdom	—	1,000	+ 1,000
United States	25,000	10,000	– 15,000
Chile	207,000	10,000	– 197,000
Argentine	137,000	—	– 137,000
Brazil	81,000	—	– 81,000
Egypt	30,000	7,000	– 23,000
Cape Colony and Natal	10,000	—	– 10,000
Australia	15,000	7,000	– 8,000
New Zealand	21,000	2,000	– 19,000
Steam boilers and parts.—			
Total	—	591,000	+ 591,000
China	—	266,000	+ 266,000
Kwantung Province	—	292,000	+ 292,000
Dutch India	—	12,000	+ 12,000
Asiatic Russia	—	19,000	+ 19,000

FERGUSON, PAILIN TYPE "R" CIRCUIT BREAKER.

1,000,000 kVA Rupturing Capacity.

The recent tests conducted at Baltimore to determine the rupturing capacity of oil switches, when powers of over half a million kVA at 13,200 volts were interrupted, together with the tests on switch contacts carrying heavy short-circuit currents up to 100,000 amperes by Mr. Philip Torchio, have emphasised a number of important points which have to be watched when designing high-rupturing-capacity breakers. They may be briefly summarised as follows:—

1. It is necessary to provide for freely venting large amounts of gas without at the same time "throwing" large quantities of oil.

2. It is possible to design circuit breakers to rupture heavy powers repeatedly if a large amount of copper is provided in the arcing contacts, the condition of the oil not being so important a factor as has hitherto been thought.

3. The construction must be such that there is no deformation of such parts as tanks, top plates, leading-out bushes, &c., due to the explosive forces set up under short-circuit conditions, the only depreciation occurring being that of arcing contacts and oil.

4. Speedy arc rupture is essential; given this condition, it is shown that on a 25-cycle circuit the arc may be expected to be extinguished in less than one cycle after the arcing tips part.

5. It is necessary that the contacts be of such a form that the passage of heavy short-circuit currents will not produce arcing due to electromagnetic repulsion before the operating mechanism has time to function.

6. Provision must be made for so bracing the contact supports that distortion due to the repulsion of current-carrying conductors is obviated.

All the above-mentioned factors, it is claimed, have been taken care of in Messrs. Ferguson, Pailin, Ltd.'s type "R" circuit breakers for high-rupturing capacity, which pattern of breaker, it is estimated, is capable of breaking 1,000,000 kVA, and is designed for various currents and pressures up to 2,000 amperes and up to 22,000 volts. A typical 3-phase electrically-operated circuit breaker of this class is at present working in the Manchester Corporation generating station controlling a group feeder of 2,000-ampere capacity at 6,500 volts, and is shown in fig. 1, which illustrates the complete breaker with one of the tanks lowered.

The circuit breaker has a large volume of oil, totalling 180 gallons per three-phase unit, which permits a 28-in. head of oil over the arcing contacts, thus subjecting the arc to a heavy hydrostatic pressure. The oil tanks are so arranged that any gaseous vapour is expelled through vent pipes, suitable gaskets being fitted between the tanks and the top plate. The vent pipes, of which four are provided, are each 3 in. in diameter, and four of them are fitted to each single-phase tank. The vents are of the liquid baffle type, so that any gaseous vapour can be immediately expelled by internal pressure, while the emission of oil is prevented. The vent pipes can be connected to a common exhaust-pipe system incorporating non-return valves.

A separate oil tank is provided for each single-pole unit; each tank is a solid-drawn steel cylinder with a dome-shaped bottom, 24 in. in diameter, and capable of withstanding 700 lb. per sq. in. pressure. The tank is carried on a flat-bottom steel cradle that is supported from the frame by eight 1¼-in. diameter steel rods, and a tank-lowering device is provided to facilitate the inspection of the switch contacts. The top frame of each single-pole unit is a substantial dome-shaped steel casting; hard-drawn high-conductivity tubes constitute the main terminals and are carried through the steel base in condenser-type bushings, no porcelain whatever being used in the construction of the switch.

The fixed contacts are of the self-aligning finger type, while the moving contacts are of "V" shaped section—a type of contact that is said to be eminently suitable for high-rupturing capacity breakers, as on the passage of heavy short-circuit currents the two fingers carrying current in the same direction are attracted to one another and increase, rather than decrease, the pressure of contact between the moving and fixed portions, thus preventing arcing before the operating mechanism functions.

Fig. 2 shows the auxiliary break contacts in the "open" position. When the main breaker is closing, the auxiliary break contacts are closed against the action of two powerful helical throw-off springs contained in the tubular steel guides seen in the illustration. A very high speed of contact separation is obtained by means of an ingenious mechanism contained in the steel-tube guides, which superimposes the velocity of the main contact bar on to the velocity of the auxiliary break contact bar. This device, in conjunction with the powerful throw-off springs and the quadruple series break, enables a 36-ft. per second speed of contact separation to be attained. Retardation at the end of the stroke is obtained by allowing a quantity of oil to act as a cushion in the steel tube, thus preventing any shock to the mechanism. The oil for this purpose is automatically supplied from the oil tanks, and requires no attention.

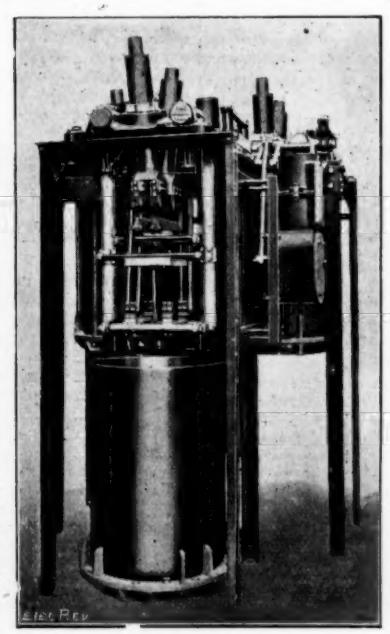

Fig. 1.—A Ferguson, Pailin 2,000-A, 6,500-V Circuit Breaker.

Fig. 2.—Main and Sparking Contacts in "Open" Position.

Large arcing contacts, all of which are renewable, are provided with a good mass of metal, and this feature, together with high-speed separation of contacts, enables the breaker to cope with repeated faults.

Owing to the disposition of the conductors leading to the arcing contacts, a slight reactance is automatically introduced into the circuit before final breaking.

The conductors inside the switch are strongly braced together with bakelite spacers so as to prevent any distortion through the repulsive forces set up when carrying short-circuit current.

The breakers can be supplied suitable for mechanical operation or electrical operation as desired, the whole of the link mechanism being contained in the top of the oil tank. The insulating material employed throughout in the construction of the switch is bakelite.

It will be noticed from the illustration that the three phases are mounted delta fashion, a procedure that was adopted in order to economise space; generally, the three phases would be mounted in one line. The breaker has many unique features, and is well adapted for use in "super" power stations.

The Berlin New Electric Railway.—Concerning the partly completed electric railway between Gesundbrunnen and Neu-Kolln, the Supreme Court, in an action brought by the Berlin City Council against the A.E.G. High-Speed Railway Co. to compel the latter to finish the works according to contract, has decided in favour of the city, although admitting that a contract would lapse with the dissolution of the company. The principal shareholder in the company—the A.E.G.—has now succeeded in convening a meeting to propose the liquidation of the High-Speed Railway Co., the adoption of which will enable the latter to evade the completion of the railway. It appears that the increased cost of construction, owing to well-known circumstances, caused the suspension of the work.

HIGH-SPEED ALTERNATORS.

Some Problems and their Solution.

By J. ROSEN, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

(Concluded from page 313.)

Cooling.—In 1913 Messrs. C. A. Parsons & Co. decided to test filters of various makes installed in different parts of the country. A new type of wet air-filter resulted, but it was suggested that apparatus which cooled the air circulating round a closed system of ducts might be an improvement; the same air would be repeatedly circulated, and it would, therefore not be necessary to clean, but only to cool it. In addition, it was decided that the air must not come into contact with the cooling fluid. The cooler had copper tubes with sheet-iron gills, and was in reality a radiator taken from a 4-ton lorry.

The staff of the Battersea Corporation electricity works in 1912 took out a patent for a cooler using water from the condensate, and proved the advantages of the enclosed air system. An alternator air-cooler, to deal with 18,000 cubic ft. of air per minute, was installed in 1919 by Messrs Parsons on a 3,000-kW plant in the Blaydon power station of the Newcastle-upon-Tyne Electric Supply Co., which, since its installation, has run without any fault developing; this was the first design with gilled tubes to be installed and put into commercial operation in this country. The Parsons Co. has a number of

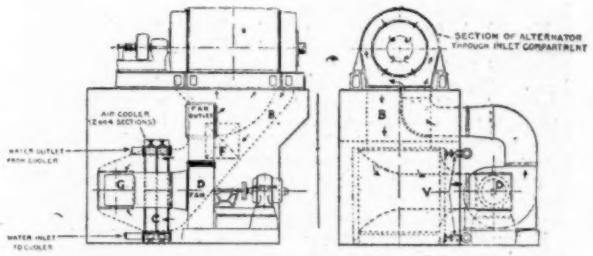

Fig. 4.—Closed Circuit Air Cooling System.

coolers for alternators, with a total capacity of a quarter of a million kVA, either in operation or under construction, for this country or abroad. At the time the above-mentioned cooler was installed, the General Electric Co. of America was apparently experimenting on the same lines.

The system is of very compact design. Owing to slight unavoidable air leakages (which have to be made up) it is true that the circulated air is very gradually replaced, but the ducts can be arranged so that the leakage occurs at one point only, the incoming air being previously cleaned and dried. In the author's experience, however, this complication has proved unnecessary. The fire risk is reduced, as the actual weight of air available to feed an internal fire in the machine is small and the oxygen therein would be rapidly consumed.

The designers of the Gennevilliers power station, Paris, where coolers are installed, have planned a system for increasing the nitrogen content in the air to such an extent that it will not support combustion. This, in the author's opinion, is an unnecessary procedure.

Fig. 4 illustrates a simple layout of the closed circuit air system of ventilation. The air is forced from the outlet of the fan D, through the alternator, into the foundation block in which is embodied the cooler C. On leaving the cooler an air conduit E leads the cool air back to the suction side of the fan D. Single water-tubes can be readily withdrawn and the coolers are built in sections, each mounted on wheels that fit into guides in the floor and ceiling of the air-cooler chamber. Valves V enable a section to be isolated, and facilitate the withdrawal of individual sections. Doors F and G give access for inspection and enable external air to be passed through the alternator when required. In the latter event door G would be swung round so as to prevent further circulation of air through the cooler *via* the alternator when the latter is out of commission. Any section can be opened or removed while the alternator is in commission.

The most modern scheme of water cooling is illustrated in fig. 5; the rotor is cooled by water which enters and leaves at the same end, avoiding the complication of water connections at the coupling end of the rotor. The water enters through the stationary pipe A into the rotating tube B fixed to the rotor shaft. It passes along the central axis of the rotor outwards radially through the holes F and returns through the longitudinal weldless steel tubes G immediately under the rotor windings, and so radially inwards, through the radial holes H, to the annular space J between the pipe B and the rotor body, exhausting through the perforated cap C into the water box formed in the end pedestal. The closed water system is adopted, since it is necessary to add chemicals to the water to prevent corrosion of the passages. Only in special circumstances can water cooling be efficiently employed, *e.g.*, in rotors where cooling water considerably below atmospheric temperatures is available. In using cold water, every precaution must be taken to avoid surface condensation of moisture from the air.

Instability of Exciters.—As a rule, instability can be overcome by the provision of a main field regulator, which enables the exciter to work well up on the saturation curve, or an exciter field rheostat, with an exciter designed suitably for the lower voltages required for synchronising the alternator. It is advantageous to eliminate the main field regulator and to design the exciter to be stable over a very wide range of voltage. Creepage of voltage has been overcome by introducing saturation gaps in the exciter magnetic circuit, by suitable designs of magnet frame, and, in slotted armatures, by working the armature teeth at a high magnetic density.

So far as the author is aware, the phenomenon of the reversals of the alternator excitation current has not hitherto been explained, so that the following explanation may prove of interest.

In fig. 6, E is the exciter coupled to the main field winding M, its shunt field being S. If the shunt-field switch K is opened suddenly the voltage generated by the exciter at E will rapidly collapse, but since this voltage is applied across the magnet winding M, which has a high self-induction, the current in the circuit EM does not fall so quickly. Consequently, the back electromotive force of the magnet M continues to supply the circuit EM after the field circuit S is broken, and the exciter voltage has dropped away, but fig. 7 shows that the polarity at the exciter terminals is actually reversed. With the exciter brushes set in the usual position in advance of the neutral, the exciter armature current has a demagnetising effect on the exciter field and causes reversal of polarity; but if the brushes were rocked to a position behind the neutral the current through E would have a magnetising

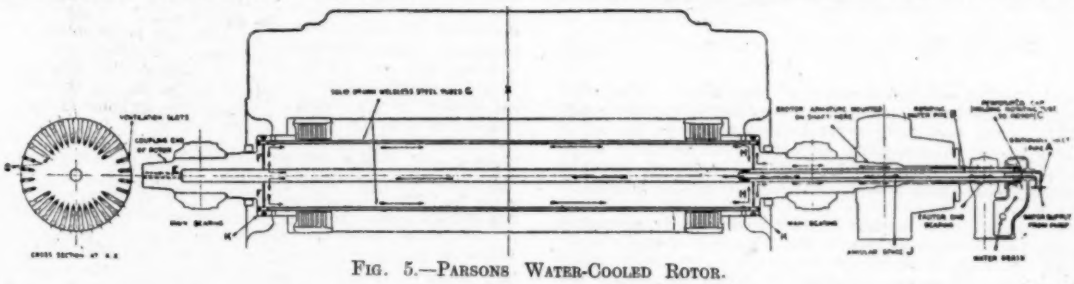

Fig. 5.—Parsons Water-Cooled Rotor.

effect and tend to preserve the original polarity of the field. Thus this type of instability could be remedied by rocking the brushes backward or by putting compounding turns on the exciter field, which must be directly compounding and not demagnetising turns. The reason for this is that when the field circuit S is broken (see figs. 8 and 9) although the polarity at the exciter terminals is reversed, the current in the circuit EM continues to travel in the original direction, due to the back electromotive force induced in the rotor windings, previously mentioned; only a very few turns of compounding are necessary to prevent reversal. There is no objection to the compounding turns, but the rocking of the brushes backward is undesirable, since it is likely to cause sparking when the exciter is heavily loaded.

A similar exciter reversal has been repeatedly produced by

the careless manipulation of the exciter field rheostat in power station operation. Consider the machine to be running preparatory to synchronising. Too much of the resistance in the exciter field rheostat may accidentally be cut out, due to the slow rise of the alternator voltage. Consequently, the exciter current and alternator voltage rise a good deal above the normal required for synchronising. The exciter field resistance is reinserted to neutralise this effect, and may cause the exciter voltage to collapse rapidly. This will have a similar effect to that occurring when the exciter field is entirely interrupted, and fig. 7 illustrates the conditions obtaining.

Sudden changes of load and sudden short-circuits also cause reversals of the field polarity of the shunt-wound exciter. Under these conditions the voltage induced in the main field circuit is several times the normal exciter voltage, and therefore passes an increased reversed current through the shunt field. Compounding the exciter overcomes the difficulties entirely.

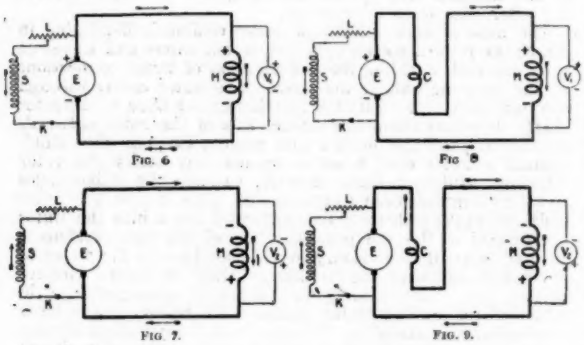

Fig. 6 Fig. 8

Fig. 7. Fig. 9.

Shunt-wound exciter (fig. 6) normal; (fig. 7) main field acting as generator, exciter field and polarity reversed.

Compound-wound exciter (fig. 8) normal; (fig. 9) momentary condition showing current in series winding overcoming effect of reversed shunt field current, main field acting as generator and exciter terminal polarity reversed.

E, exciter; S, exciter shunt field; V, normal exciter voltage; L, shunt field rheostat; K, shunt field switch; V, several times normal exciter voltage on sudden short circuit; C, exciter series winding; M, rotor winding.

Fig. 6, 7, 8 and 9.—Stability of Exciters.

Eddy Currents in Rotors.—In three-phase turbo-alternators voltages are induced in the rotor, resulting in currents circulating in the rotor windings and body. The resulting eddy currents increase the temperature of the alternator, lower its efficiency, and may reach a magnitude sufficient to heat the metals so as to affect their mechanical properties and to cause arcing. The remedy may be applied to the rotor in two ways: (i) By short-circuiting, *i.e.*, bonding the caps into contact with the rotor body, or by providing special short-circuiting rings at the end of the body. (ii) By insulating the cap from the body so that currents will not stray into them.

The latter remedy is the less satisfactory and, moreover, more difficult to accomplish without radical departure from the best mechanical construction of the rotor. The first remedy was applied in a simple way by extending the bonding strips from under the rotor keys to the caps, having a locally-increased cross-sectional area to fill the clearance space between the cap and the body as illustrated in fig. 10, the caps and keys being shaped, if necessary, to take the additional copper area.

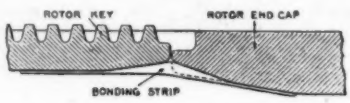

Fig. 10.—Cap and Body Bonding Strip.

Field Switch.—The author has been repeatedly requested to express an opinion as to whether the use of a quick-break field switch without discharge resistance in the main field circuit is essential in an emergency in order to reduce the alternator voltage to a minimum with least possible delay.

Tests show that, although every precaution may be taken in the design of alternators, heavy currents will circulate through the rotor on breaking the field circuit by means of a quick-break switch without discharge resistance. In the author's opinion it is inadvisable to subject the rotor repeatedly to these currents. It is recommended that the quick-break switch should be installed, but it should be made to operate in emergency only, and should not be operated when tripping the alternators by hand from the busbars during normal operation.

Discussion at Cardiff.

Mr. J. Rosen read his paper at the Western Centre of the Institution of Electrical Engineers on February 5th, and in opening the subsequent discussion

Mr. J. W. Burr (Borough Electrical Engineer, Swansea) referring to the size of sets, considered that whilst great strides had been made regarding capacity, generating at higher voltages had been neglected. With long transmission schemes it would certainly appear less expensive to generate at higher voltages rather than to introduce transformers, &c. He also considered the quick-break field switch very harmful and preferred a "slow-dying" field.

Prof. R. G. Isaacs (Swansea University) said, with regard to the author's method of measuring the distortion of the end caps, that it was remarkable how he was able to get such a close correspondence of results. There was an alternative method of using practically a radio transmitter of the continuous-wave type which, if made up as an air condenser, would give a method of interchanging any distance of air condenser. The rotor end cap would form one end of the condenser and a metal disk would take the place of the author's spark, and by putting an oscillograph in the vibrating circuit a curve would be drawn out. Calibration of the oscillograph values would be done with the machine at a standstill, and that would certainly be a simpler method, and would give more accurate results. Regarding exciters, a minor defect was their failure to excite when starting again after the set had been shut down with the fields closed. Probably the main field held its magnetism longer than the exciter, and weak a.c. was generated in the rotor windings by the varying flux caused by heating, which might demagnetise the exciter field. If this explanation was correct, then a series winding would help, and in the case of sets which had to be brought into service quickly it would be worth while to provide separate excitation. The closed air system of ventilation described by the author gave a very useful easy method of measuring losses in alternators, and if the system came into general use it would give most valuable information as to the increased losses in alternators due to age.

Mr. W. A. Chamen (South Wales Power Co., Ltd.) mentioned that he was installing a 15,000-kVA Parsons set, and he would be better able to criticise the paper 12 months hence. He was very anxious to use the closed system of ventilation, but Messrs. Parsons had advised him not to do so, although full provision had been made for its use later on. The temperature of the Taff was about 80 deg. in the summer and the makers would not guarantee anything with a temperature over 60 deg. Messrs. Parsons, through Mr. Rosen, were helping things forward considerably by providing material for such an excellent paper.

Major E. I. David (Powell Duffryn Colliery) thought the critical speeds of long rotors must be somewhere about the running speeds. With regard to the oils used for insulation, might they not oxidise in course of time, being vegetable, and therefore harden? He preferred open to closed-slot machines, as the latter necessitated more joints in the conductors, and he would prefer to eliminate joints rather than multiply them, as was the case in the Parsons machine.

Mr. H. Ellis (A. Ellis & Partners, Ltd.), thought it was unfortunate that the speed of most alternators was limited to 3,000 r.p.m. He considered that the closed-air system of ventilation would lead to the solution of many difficulties—dry-air filters were a source of annoyance. Regarding circulating currents in the shaft and their effect on the journals, in some instances he had experienced very bad pitting.

Mr. G. A. Juhlin (Metropolitan-Vickers Electrical Co., Ltd., Manchester) disagreed with the author's table 1, wherein the installed figure of 3,750 kVA was given for 1917, whereas a machine of 5,860 kVA was operating at that time. He must, moreover, join issue with the author in his findings on the question of insulation. There were in this country machines of some millions of kVA, with mica steam-pressed insulation operating without any difficulty. Eddy currents had been got over by the use of laminated conductors, and it would be impossible to construct machines to-day with solid conductors, as the temperatures would be so enormous that the stator windings would be destroyed. It was not possible to obtain materials for insulation which did not finally harden, and it was difficult, and perhaps not always wise to dogmatise on any particular type of insulation. The solid rotor had been proved to be the most satisfactory. Regarding the air cooler, Mr. Juhlin contraverted the statement that manufacturers were not prepared to guarantee machines with the high temperatures existing in this country. His firm had actually designed a machine wherein the temperature condition of the cooling water was 92 deg. F., and the machine was guaranteed to meet the B.E.S.A. specification with that temperature.

Mr. W. J. Bache (Cheltenham), and Mr. Bevan (Cardiff), also contributed to the discussion, but the author reserved his reply for the *Journal*.

Ex-British Westinghouse Association.—The annual dinner of the Association will take place on March 9th, at the Holborn Restaurant. Mr. A. R. Dyer, Chief Officer, London Fire Brigade, will preside, and those who have not yet obtained tickets should write the Hon. Sec., Mr. L. S. Richardson, 14, Sydney Road, Richmond.

THE BRITISH INDUSTRIES FAIR.

LONDON AND BIRMINGHAM.

(*Concluded from page* 315.)

The Fair closes to-day (Friday). The following notes relate to further exhibits at the Birmingham Section.

Messrs. Royles, Ltd., have a varied display of equipment for steam-raising plant. This includes samples of Row's patent feed-water heater tubes which are indented alternately in directions at right angles to one another to ensure that not only the edges but also the centre of the water column are heated. A similar appliance shown is a calorifier for heating by steam bath water, or water used in circulating heating systems. Steam traps and reducing valves are shown in section, exhibiting great simplicity in construction. An actual example and a working model of a twin strainer for condensing plants, &c., appear on the stand. In this device are two separate channels each with its straining cage. These are so arranged that when one cage is choked, the water can be diverted through the other by a change-over valve, while the choked strainer is taken out and cleaned.

Messrs. Kelvin, Bottomley & Baird, Ltd., show, among other things, a colour testing cabinet for fading colours by artificial light. This is provided by a crystal quartz mercury vapour lamp. The burner tube of this is not exhausted, but works under atmospheric pressure. A small heating coil is used for starting the arc, which is gradually lengthened as the mercury evaporates. Upon switching off, the condensation of the mercury is effected very quickly. The application of this apparatus as a microscope illuminant was described in our issue of July 7th, 1922 (p. 32). The "Pneumercator" tank gauge is also exhibited. This appliance was installed in the Kilmarnock station of the Glasgow Corporation. It is pneumatically-operated, and its principal advantage is that it can be used for indicating the stocks of fuel oil or other liquid at a distance from the tanks. Another power station accessory shown is a portable CO_2 indicator which, it is claimed, will give, with careful handling, results within a quarter of one per cent. The gas to be analysed is drawn by a hand pump into a cylinder, passing through a drying chamber. It is then circulated through an absorbing chamber. When the gas is drawn into the cylinder and the hand piston is at the top of its stroke, *i.e.*, no part of it is in the cylinder, the reading of a sensitive manometer is noted, and a small indicator is adjusted to the position of the indicating liquid. When the gas has been circulated through the absorbing chamber it has lost volume through the absorption of the CO_2, and the pressure upon the manometer has fallen. To bring the pressure back to the original level, the plunger is pressed into the cylinder until the manometer level reaches the point at which the indicator is set. The percentage of cylinder capacity made up by the piston can then be read off upon the graduated piston rod; this gives a direct reading of the CO_2, absorbed, as a percentage. Another device shown is a "Vibrometer" for detecting the source of undue vibration in a machine. It consists of a reed, the length of which can be adjusted, carrying a small hammer-like head which swings over a scale. The instrument is mounted beneath the nut of a fixing bolt, and the reed portion is fitted upon a "universal" joint which enables it to be swung about until the point of maximum vibration is discovered. The sockets of the joint are marked in degrees so that a record of the position can be kept. The amplitude of the vibrations is roughly indicated for record purposes on the before-mentioned scale.

The Cable Accessories Co., Ltd., has an exhibit of a widely varied character. There are numerous lanterns for industrial and street lighting, including one designed specially for the lighting of Princes Street, Edinburgh. This is a "Holophane" refractor glass fitting borne by an octagonal hood. Within the hood are plungers by which the height of the lamp in the bowl can be adjusted. Adjustment is aided by a simple device which consists of a small wire which hangs down and indicates the proper position of the lamp. Several ceiling fans are exhibited. These are substantial machines with well-formed aluminium or mahogany blades. Mounted on ball bearings, they run with little or no noise. They have been satisfactorily reported upon by Faraday House. The "Revo" broadcasting reception set is a compact apparatus equipped with a special crystal, and with both coarse and fine inductance tuning. It is claimed that telephony has been distinctly received by means of this set at a distance of 120 miles from the Birmingham broadcasting station. "Revo" switchgear is displayed in great variety. Most of this is fitted in iron cases, with interlocking lids and operating handles. The bulk of the switches shown are for house service, but one or two larger switches and combined switches and fuses are also on view. There are samples of the firm's teak-cased distribution boards, from which a whole bank of fuses can be removed by the unfastening of two small milled nuts. For the rest, the exhibit consists of a selection of the firm's domestic electrical appliances—toasters, irons, kettles, fires, &c.

The Edison Swan Electric Co., Ltd., has a small stand on which are displayed "Ediswan A.R." thermionic valves, "Fullolite" opal lamps, neon gas sparking-plug testers, h.p. batteries for use with radio valves, and also a selection of domestic appliances.

Messrs. Lomas & Sons have a particularly beautiful display of English alabaster, including bowl fittings, and standards in both veined and "Blue John" Derbyshire alabaster.

Batteries, Ltd., exhibits samples of its nickel-iron accumulators of various sizes, and also their application to portable electric lamps, including those for miners' use.

The Rawlplug Co., Ltd., demonstrates the use of its plugs for fixing fittings into a variety of materials, and shows sets of tools for use with the plugs. The firm has now a more comprehensive range of tools. Some time ago we reviewed a booklet issued by the company, which gave hints upon the execution of numerous jobs which must be done in the average household. A list of the necessary tools was given, but now the firm has gone further and produced at a low price a set of tools of the required size. Lead plugs are also shown; these are of ⅜ in. and ½ in. diameter, and are intended for use in fixing down small machines. Aluminium fittings are also on view on the stand.

The Scarab Oil Burning Co., Ltd., in addition to examples of its burners for use with oil fuel, which are now well-known to those who had to do without coal during the fairly-recent miners' strike, exhibits examples of vessels and steel parts treated by the firm's "Calorising" process. This guards against oxidisation by excessive heat, and consists in coating the steel part to be treated with aluminium. When the temperature of the article is raised to about 400 deg. C. the aluminium oxidises and forms an alumina which acts as a protective covering against the effects of further increases in temperature. The treatment is suitable for superheater tubes, pyrometer protection tubes, valves for hot gases, retorts, and many other accessories. It is claimed that treated articles will successfully withstand temperatures up to 1,800 deg. F. The process is not confined to steel, but can be carried out on nickel, copper, and other metals.

Messrs. W. & T. Avery, Ltd., have a large array of their weighing and testing machines. Among them is an automatic coal weigher suitable for an electricity works, with a hopper containing two hundredweights which automatically tips when the load reaches the correct weight. Each load is at the same time recorded by a counter. The appliance can be fitted with wheels to enable it to serve a range of boilers. A machine for weighing liquids, similar in principle to the coal-weighing machine, is also on view. This is made to deal with from 20 lb. to 2 tons of water per load. A retaining device holds the hopper sufficiently long to drain it properly. The testing machines include one for testing helical or laminated springs having a maximum testing pressure of 3 tons. The downward movement is actuated by an electric motor, and an adjustable switch is provided to enable the load to be retained at a pre-determined magnitude. The deflection of the spring is recorded by a pointer on a dial. Other machines shown are an impact testing machine for carrying out the "Izod" brittleness test with a maximum capacity of 120 ft. lb.; and a universal testing machine, hydraulically-operated. This is designed upon the single-lever principle, the load upon the test piece being indicated by a poise-weight traversing a graduated scale upon the steelyard. The steelyard is graduated from zero to 50 tons, the finest sub-divisions representing .01 ton. With this machine the following tests can be carried out:—Tension, compression, bending, shearing (double), and torsion.

Messrs. Holt & Willetts have a larger display than in previous years of their hauling and hoisting machinery. There is an electrically-operated hauling winch capable of exerting a pull of 3 tons at a speed of 50 ft. per minute. The motor is a 15-h.p., 700-r.p.m. machine. A standard-type overhead travelling crab is on view. This will lift 3 tons at a speed of 25 ft. per minute, and will travel at 75 ft. per minute. A direct-coupled electrical hoisting gear shown will lift one ton at a speed of 100 ft. per minute; this type is suitable for either goods or passenger cage lifts, being made for loads of from 3 cwt. to 30 tons. It is of the worm-gear type, with machine-cut phosphor-bronze worm wheel and a steel worm running in an oil bath. The thrust of the worm, which is connected direct to the motor, is taken on a specially-designed ball bearing. It can be provided with push-button control and hand or electrical braking. The firm also shows electrically-driven friction hoists and pulley blocks, as well as hand- and hydraulically-operated machinery.

The Wolseley Sheep-Shearing Machine Co., Ltd., shows examples of its petrol and paraffin engines. There are two small generating sets on the stand. One of these consists of a 3-b.h.p. vertical petrol engine driving by belt a 1-kW generator; the other is a gear-coupled set, comprising a 4-h.p. engine driving a 2-kW generator. The engines have an efficient water-circulating system and pump lubrication, the camshaft and cams are one solid steel forging, and the governor is entirely enclosed, as are also the bearings. The speed is 600 r.p.m.

in the 3-h.p. size, and 500-r.p.m. in the 4-h.p. size. The engines occupy very little space: 3 ft. 8 in. by 1 ft. 9 in. in the smaller size, and 4 ft. 10 in. by 2 ft. 8 in. in the other.

Messrs. Sturge & Baker, Ltd., have a selection of combined tumbler switches and plugs, both of the interlocking and non-interlocking types. They are mounted in substantial composition cases, and the switch dollies are of insulating material. The firm also shows a number of electric fires, in which the element is in vertical spirals on a circular fireclay boss. The element is mounted at an angle and the back and sides of the fire form reflectors. There are two sizes, one with a single 1-kW element and the other with two elements of 1 kW and 600 W controlled by separate switches. In addition to these, there are small boiling rings and bowl fires with elements similar in shape to those of the larger fires. One pattern of bowl fire has a bowl only about 5 in. in diameter. The elements in the smaller appliances are fitted with plugs or Edison screws. Lighting fittings are also on view. These include shades and a cord-absorber, consisting of a spring-mounted bobbin in a spherical case and forming a simple alternative to counterweight fittings. Another device shown is a "universal" shade fitting, which permits a lamp shade to be fixed in any lateral or vertical position in a very easy manner.

Messrs. Accles & Shelvoke, Ltd., show a number of small motors and generators for polishing, &c., including a battery-charging dynamotor with charging board, &c. A new appliance to be seen on the stand is a tire-inflator, which consists of a ¼-h.p. motor driving a crank shaft to which are connected the piston rods of four small air pumps, all feeding into a common supply tube. A relief valve is fitted, and this can be set to operate at any desired tire air-pressure.

The Falkirk Iron Co., Ltd., is not paying so much attention to its electrical products this year. Only one electric cooker is shown—a 6.5-kW appliance with two oven elements and two grills, each controlled by a three-heat switch.

Premier Electric Heaters, Ltd., has a similar display to last year's—a collection of small domestic appliances remarkable for their excellent finish and sound construction. The "Smoothwell" iron is given prominence, and the single hot spot is demonstrated. A board at the back of the stand enables the various processes in the construction of the iron to be traced, from the pressing of the case and the cutting of the mica insulation to the finished article. The kettles form a wide range, being in five sizes from 1½ to 6 pints. An important item in the appliances exhibited is the strong connector which is constructed to give a safe and positive contact. Universal-voltage kettles are shown, as well as a number of urns, fires, egg-boilers, and a cooker.

Messrs. W. & S. Summerscales' Sons exhibit an electrically-driven washing machine, which is a development of a hand-operated machine which has been on the market for some years. The operating portion is an oscillating dolly, upon each side of which are mounted a pair of vacuum cups or "possers." These press the clothes being washed against the ends of the wooden container, causing the water to be forced through them. The machine is operated by a 3/16-h.p. reversible motor, which also drives a substantial wringer. A foot control is fitted, and the drive consists of a chain on hardened steel sprockets. Ball bearings are used at both ends of the drive.

Messrs. William Soutter & Sons, Ltd., show lighting fittings, including crystal and alabaster bowls, "T. M. C." crystal and valve radio receiving sets, and numerous small electrical accessories. One speciality is a two-pointed iron with the connector in the centre; this is so shaped to save turning the iron round. It is fitted with a loose handle for export purposes.

The Feed Water Specialists Co. exhibits many examples of its colloidal preparations for dealing with impurities in boiler feed water, and demonstrations of their action are given. It is seen how the gels forming the colloid take up the impurities in the water and are precipitated, collecting into a sponge-like formation. "Algor" colloids are specially prepared for each individual case after an analysis of the water being used.

Messrs. Mark Webber, Ltd., show their semi-automatic generating set, consisting of a 5-h.p. petrol engine direct coupled to a 1.5-kW generator. The margin between the power of the engine and that required to drive the generator is utilised for driving farm machinery direct from a fly-wheel on the engine-shaft. The control board is so arranged that the batteries can be changed over from charge to discharge without extinguishing the lights. Arrangements are made to cut out the field when the engine is required for direct power purposes. The firm also shows examples of nickel-iron accumulators.

Messrs. Matthews & Timings and Ackroyd & Best, Ltd., show examples of electric lighting fittings; the latter firm has many artistic bowls and shades in clear, opal, and coloured glass.

Messrs. Bamfords, Ltd., have on their stand a 1-kW and a 2-kW electric lighting sets. These consist of low-speed petrol engines driving, by means of belts, shunt-wound d.c. generators giving an output at 50/75 V. The two machines are mounted on slide rails, together with an enamelled-slate switchboard bearing ammeters, voltmeter, switches, fuses, and an automatic cut-out. The smaller (1-kW) plant is equipped with a 27-cell, 100-Ah battery, and the other with a 150-Ah battery. The firm also shows a number of pumps, chaff-cutters, and other farm machinery.

Carron Company's exhibit includes a table range suitable for a small restaurant, and a "No. 309" cooker capable of cooking food for five or six persons (5.75 kW). The latter, similarly to the table range, is equipped with 3-heat rotary switches, and is highly finished. A selection of the firm's artistic electric fires is shown, including an "Adams" fire in armour-bright steel, with a curved front. As well as its own products, the company also exhibits a number of "Universal" urns, kettles, percolators, &c.

Birmingham Products, Ltd., has a number of radio-telephony receiving sets, both of the valve and crystal detection types, as well as accessories, including frame aerials, loud speakers, &c.

Messrs. R. S. Thacker & Co., Ltd., also display radio apparatus, including a large cabinet set with several valves and a loud speaker. Victoria Electrical (Manchester), Ltd., is another firm showing apparatus of the same nature. This firm's speciality is the "unit" type set, to which extra valves, &c., can be added *en bloc* and connected up by links.

Messrs. John Thompson (Wolverhampton), Ltd., exhibit models and actual examples of water-tube boilers.

Messrs. W. Canning & Co., Ltd., show complete equipment for electro-plating, polishing, bronzing, and lacquering. There are a number of low-voltage (6 V) generators with outputs ranging from 15 to 3,000 A, polishing lathes, and plating vats, as well as chemicals—metal salts, &c.

The Firth-Brearley Stainless Steel Syndicate, Ltd., has many examples of a varied nature of articles made from its product, including ball and roller bearings, turbine blading, and gauges.

The British Engine, Boiler, and Electrical Insurance Co., Ltd. (British Electrical Repairs, Ltd.), exhibit a number of repaired armatures, &c., by which replacement has been rendered unnecessary.

Productive British Grinders, Ltd., has a running display of electrically-driven and other grinding machines. These include cylinder grinders mounted on an eccentric to give uniform abrasion over the whole of the interior of a cylinder.

Ebonestos Insulators, Ltd., and the Paragon Rubber Manufacturing Co., Ltd., have displays consisting of numerous hard-rubber articles, including telephone ear-pieces and hand-grips, components of radio-telephony receiving sets, switch handles, &c.

The Hockley Chemical Co., Ltd., has in operation a number of plating vats, polishers, &c., and the

Frederick Crane Chemical Co., Ltd., has, among other exhibits, preparations for frosting and colouring electric lamp bulbs.

Wondersigns, Ltd., shows a novel advertising device, which consists of a steel plate enamelled to look like wood, upon which are placed magnetised letters. As the latter are tested to lift fifteen times their own weight, they stay where they are placed in spite of vibrations and jolts.

Messrs. Newton Bros. (Derby), Ltd., have written pointing out that in our note upon their exhibit, which appeared in our last issue, we were in error when we stated that the arrangement enabled "gear wheels to fall into mesh." The whole of the gear wheels are always in mesh, and revolve or are stationary in accordance with the action of the solenoid plungers. No part of the gear reverses with regard to the direction of rotation, the parts being arrested as may be required, travelling in one direction or the other.

THE NEW CABLE STEAMER "FARADAY."

Interesting Launch on the Tyne.

An interesting launch took place at the Jarrow shipyard of Palmer's Shipbuilding and Iron Co., Ltd., on February 16th, when the twin-screw cable steamer *Faraday*, which has been built to the order of Messrs. Siemens Brothers & Co., Ltd., of London and Woolwich, successfully took the water. The vessel is of the following dimensions:—

Length over bow sheaves	415 ft.
Beam	48 ft. 3 in.
Depth to upper deck	29 ft. 3 in.

She has been constructed of steel, under special survey, to conform to class 100 A1 with Lloyd's Register of Shipping; she is of the shelter dock type with free-board; and has a clipper stem adapted for carrying three cable sheaves, as shown in the accompanying illustration; a cruiser stern, with two sheaves fitted on the starboard side; and two masts with schooner rig. A double bottom is fitted fore and aft, adapted for carrying either water ballast or oil fuel. Additional ballast capacity is provided by means of deep tanks to ensure ample immersion of the vessel when her cable is discharged. Oil fuel is also carried in the cross bunker at the fore and aft ends of the cable tanks and separated from them by air spaces, the total storage of fuel oil being sufficient to provide for a steaming radius of 10,000 miles. The ship has four cable tanks, all adjacent to each other, having a total coiling capacity of about 92,000 cu. ft.

The cable-handling appliances are of Messrs. Siemens' pattern, and the main cable machinery is being constructed by Palmer's Shipbuilding and Iron Co., Ltd.

Spacious accommodation is provided for the ship's officers, cable staff, and crew; the total number of people accommodated being over 150. A testing room and large workshops, cable, refrigerator, and fresh-water storage are provided, the *Faraday* being one of the largest and most modern vessels of her type afloat. She is to be fitted with twin-screw triple-expansion engines having cylinders 21 in., 34 in., 57 in. × 39 in. stroke, steam being supplied by three boilers fitted with Howden forced draught, having a working pressure of 180 lb., and burning oil fuel. The engines and boilers are being constructed by Palmer's Shipbuilding and Iron Co, Ltd.

The new vessel is the second cable ship bearing the name of *Faraday* to be owned by Messrs. Siemens. The original vessel of that name is now going out of commission after nearly half a century's work. Altogether the old *Faraday* has laid some 50,000 miles of submarine cables in all parts of the world, including eight cables across the Atlantic Ocean, while she has also carried out many repairs to cables in waters of varying depths up to 3,000 fathoms.

The new vessel was gracefully named by Mrs. G. Mure Ritchie, wife of the chairman of Palmer's Shipbuilding and

Fig. 1.—The New Cable Ship "Faraday."

Iron Co., Ltd., and of Messrs. Siemens Bros. & Co., Ltd., and in wishing "Success to the *Faraday* and her owners, and good luck to all who sail in the ship," Mr. G. M. Ritchie said that, while Palmer's had built many important vessels, the cable steamer *Faraday* was a noteworthy addition to the list of over 900 ships of widely divergent types which they had built. She would serve millions of people by her cable-laying, which, by linking up continent with continent, made it possible to keep in touch with events in all parts of the globe and permitted that rapid interchange of views which frequently did so much to dispel misunderstandings.

The Right Hon. Sir William Bull, Bart., M.P., in replying on behalf of Messrs. Siemens Bros. & Co., Ltd., gave a very interesting account of the work done by the old *Faraday*, which, he said, was launched on the Tyne 49 years ago almost to the day. She was one of the earliest twin-screw vessels, was said to be the first vessel equipped with electric light, and carried one of the first of Sir William Thomson's compasses. She did splendid service during the war under Captain Gange.

ILLUMINATING ENGINEERING.

A discussion on the above subject was opened by Mr. C. E. Greenslade and Mr. J. E. S. White at the meeting of the Illuminating Engineering Society on January 16th. The authors recalled the varied topics dealt with by the Society since it commenced work in 1909, which had served to crystallise much useful information. Much of the Society's work was educational, but the time appeared ripe for extending this work in several directions.

In addition to special addresses before bodies vocationally interested in lighting, there was an opening for popular lectures to the general public. There were few subjects that lent themselves better to such lectures than illumination, which essentially involved an "appeal to the eye." Turning to the main question of instruction in schools and colleges, the authors drew attention to the desirability of initiating very simple lectures for children in schools which should deal with the subject in a bright and attractive manner. It would be a great advantage if the new generation grew up with a better appreciation of the benefits of good lighting, so that they would not tolerate bad conditions in their homes, or in the business with which they were associated. Somewhat more advanced lectures might likewise be arranged in secondary schools.

The authors then proceeded to discuss in some detail the methods of providing instruction in illuminating engineering at colleges and polytechnics. Many such institutions had courses in which some instruction on lighting matters was included, but in some cases the matter needed to be revised and brought abreast of modern methods. Engineering students should get some insight into the ideas that guided the architect in lighting public buildings, museums, picture galleries, &c. In courses for architectural students there should likewise be some reference to modern methods of artificial lighting. Courses for wiremen and gasfitters should include something about the arrangement of lights. The aim should be to devote special attention to applications of light. In the past too much attention had been given to lamps and too little to their use in practice. Lecturers should be on the look-out for striking experiments. In laboratory work there should not be merely experiments on a photometric bench, but also tests with illumination photometers devised to illustrate the effects of different systems of lighting and the order of brightness met with on ceilings, lantern screens, &c. It would be a great help to teachers if some hints on lecture experiments and laboratory work could be collected and published, and also if the Society could arrange to have a standard set of suitable lantern slides prepared for loan to lecturers.

The authors presented rough suggestions for a syllabus of lectures and for laboratory work and concluded the paper by a series of questions regarding the arrangement of courses. The question was also raised whether the time was ripe for a special illuminating engineering department at some central educational institute, and it was suggested that in a few colleges post-graduate courses, on the lines already adopted at the Johns Hopkins and Pennsylvania Universities in the United States, might be organised.

The discussion was opened by Dr. F. T. Chapman, of the Board of Education, who, while disclaiming any official sanction for his remarks, expressed his sympathy with the aims of the Society. He agreed that illumination had been neglected in educational schemes in the past. As regarded schools, he thought that possibly a few lectures to teachers might enable them to deal with the subject. Special lectures on illumination might be included in courses at technical colleges, a larger amount of time being allotted to the subject for advanced students who were disposed to specialise. He hardly thought, however, that the time was ripe for a full day course in illuminating engineering, though possibly some men might take a post-graduate course in the subject.

Mr. A. Blok agreed as to the importance of the subject. In preparing a standard syllabus they should avoid anything too cut and dried, but guidance would doubtless be useful.

Miss E. Squire (Factory Department, Home Office) from her experience in industrial areas agreed that such courses on lighting as those suggested would be most useful. In approaching managers of factories and workers she had found that much misconception on lighting matters existed.

Mr. L. Gaster recalled that several series of lectures had been arranged with the co-operation of the L.C.C. in 1912. He also referred to a series of queries that had been circulated amongst colleges prior to the meeting. From the replies received it appeared that some treatment of illumination was given in courses at many institutions, and a general appreciation of the offer of co-operation by the Society had been expressed.

Amongst others who spoke, Professor French, of Leeds University, gave a most interesting account of the methods pursued in courses under his supervision. Mr. S. Skinner, principal of the South-Western Polytechnic, pointed out that illuminating engineering should not be regarded as an isolated subject, but studied in connection with many others in which lighting played some part. Mr. W. A. Bishop referred to courses of study for those in the gas industry.

At the conclusion of the discussion those present were much interested in a demonstration of a new portable projection apparatus utilising light from a 500-watt gasfilled lamp. An image 2 or 3 ft. square was formed of the lantern slide, and it was stated that the brightness was sufficient to enable the apparatus to be used in daylight. It should, therefore, prove useful in schoolrooms and other rooms of small size, where only a moderately large picture was needed and where daylight could not conveniently be excluded.

Electric Church Bells.—It is reported that in future the bells of Notre Dame Cathedral, Paris, will be rung by means of electricity, and that elaborate mechanism is being installed in the towers of the famous cathedral with that end in view.—*Daily Mail.*

TRANS-OCEANIC RADIO-TELEPHONY.

A Record of Successful Experiments.

(*Report of lecture delivered by* Dr. H. W. Nichols *before the* Institution of Electrical Engineers.)

Dr. H. W. Nichols, who is in charge of the research and development laboratories of the American telephone and telegraph companies (who with Mr. H. T. Friis recently spent some weeks in this country in connection with the experiments referred to below and in our issue of January 19th), at the February 22nd special meeting of the Institution gave a short account of the experiments that are being carried out by the American Telephone and Telegraph Co. and the Radio

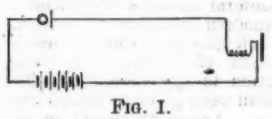

Fig. 1.

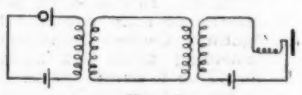

Fig. 2.

Fig. 3.

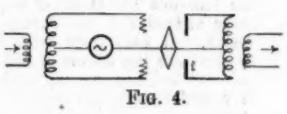

Fig. 4.

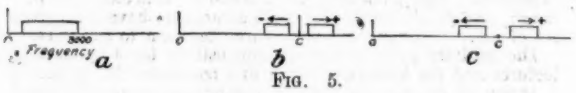

Fig. 5.

Corporation of America, in conjunction with the International Western Electric Co. in this country, to determine signal strength and other data which will allow them ultimately, if conditions warrant and there is a demand for it, to engineer a transatlantic radio-telephone circuit. The lecture was illustrated with a number of diagrammatic lantern slides to make clear the theoretical nature of the work in hand, and these

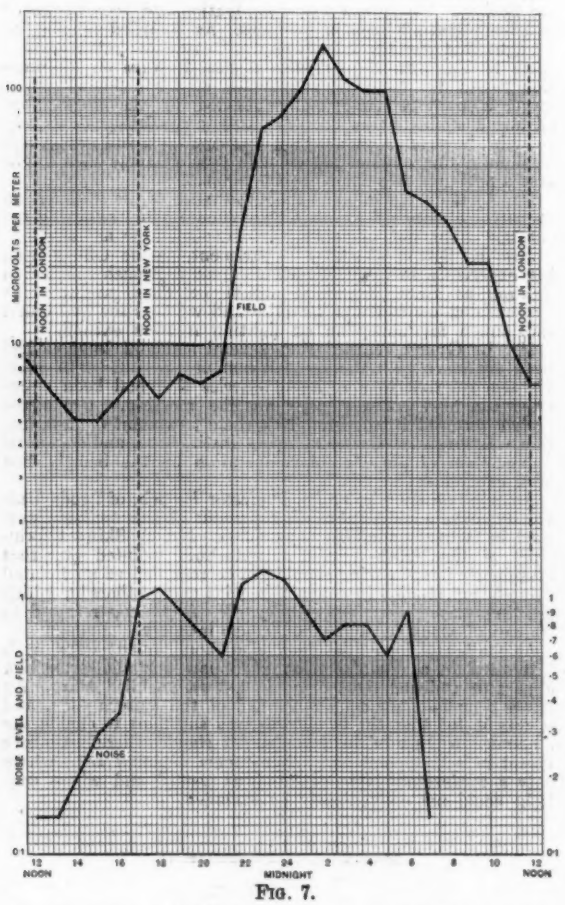

Fig. 7.

were followed by photographic illustrations of the transmitting plant at Rocky Point, Long Island, that is being used in the tests which are to be continued for a whole year in order that those in charge may get to know with a close degree of approximation the signal strength received on this side during the various seasons of the year per kW of transmitting energy available at New York, and also to ascertain the magnitude of the noises likely to be encountered. Incidentally, it may be mentioned that Dr. Nichols has already developed a system of

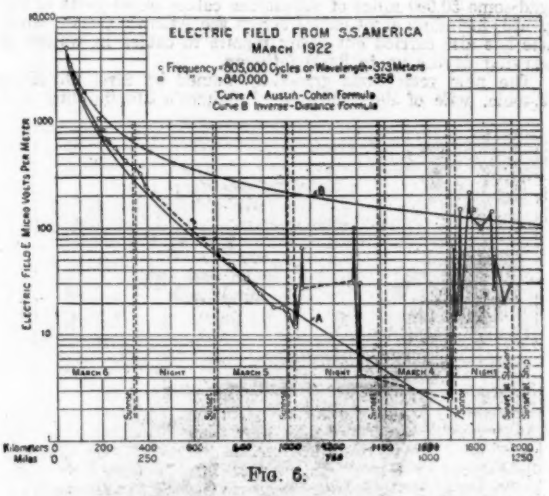

Fig. 6.

wire and radio telephony for the use of subscribers to the Bell telephone system in America, by means of which it is possible to communicate with any ship, properly equipped, within 200

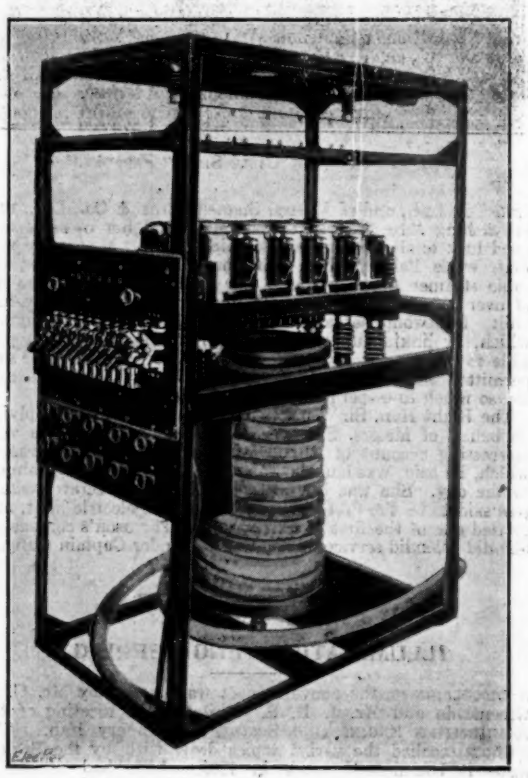

Fig. 8.

or 300 miles of the coast. We understand that these facilities have not yet been so fully used as they might, owing mainly to the noise trouble, and no doubt the experience gained in the transatlantic experiments will have a considerable bearing upon the future of this more limited scheme.

Dr. Nichols' first diagrams were those of a simple ordinary telephone circuit consisting of a line, microphone, battery, and receiver in series (figs. 1 & 2), by the aid of which he explained the relationship of the carrier current to the signal current, and gave a simple formula, the condition aimed at being to restrict the carrier current to the transmitting apparatus inasmuch as it contains no element of signal current. In the first diagrams the carrier current was d.c., but in the next diagrams (figs. 3 & 4) an a.c. was assumed for the purpose, and from this the lecturer explained how transmission is effected with the aid of upper and lower side bands by means of which the a.c. carrier current can be modulated, the actual exclusion of the carrier current from the line itself—a very important factor—being indicated by fig. 5c. In this way the necessary signal strength can be maintained with much less power, the reduction in power obtained being of the order of from one third to one sixth.

Fig. 9.

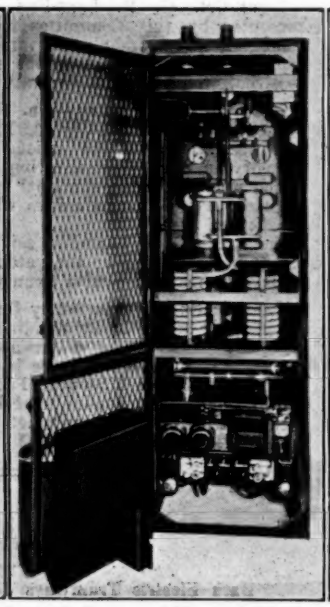

Fig. 10.

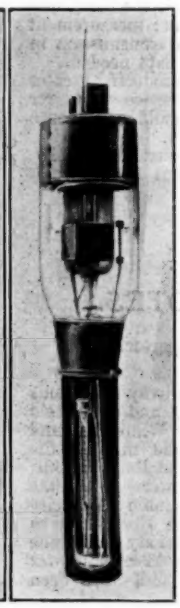

Fig. 11.

All this, said Dr. Nichols, applied to wire telephony, but it also applied to radio-telephony, the only difference between the two being that the former made use of a wire circuit and the latter used the ether. The ether, however, was more like a condenser than a copper wire, and this necessitated the use of high frequencies. Further, the characteristics of the ether were very much more variable than those of a copper wire. There was a tremendous difference between day and night characteristics of the ether, and even between parts of the same day; in fact, on short-wave lengths there were variations from second to second which it was very difficult to take care of.

The most important factors in long-distance radio-telephony were the use of long-wave lengths (to reduce the power to as low a figure as possible, because in the summer the amount required for transatlantic work might be of the order of 1,000 kW) and not to use any wider range of frequency than could be avoided. The frequency required for good transmission of the human voice was about 3,000 cycles, and something higher for music. The range of wave lengths at present available for transatlantic communication had been fixed by the London Convention at 8,000 metres and upwards, and it was not likely to be changed much in the near future. The longest wave length which was likely to be used immediately was probably 30,000 metres, which was 10,000 cycles, and allowed a range (as between 8,000 metres wave length) of 27,500 cycles for transatlantic communication. Modulating in the usual way, there would be produced a carrier and two side bands, each of the latter being 3,000 cycles wide or 6,000 in all (fig. 5). That would allow for about four radio-telephone channels without any provision for telegraph channels, but the transmission of only one of the side bands would enable two telephone channels to be used and leave room for radio-telegraph channels. Apparatus had been built which conformed with these ideas, economising in power and, by sending out only one side band, occupying the minimum frequency range.

Describing the slides of the actual apparatus, Dr. Nichols said that a modulated wave of very low power was first generated, 5 watts or thereabouts, using repeater type of tubes. Both side bands were generated, and the carrier was eliminated by the balanced modulator shown in fig. 4. Then, by means of valves, one of the bands was cut out, leaving 2 or 3 watts of single side band high-frequency telephone current at about 55,000 or 57,000 cycles. That was amplified to 300 watts; passing through another amplifier (figs. 9 & 10) it was increased to about 5 kW, and through still another amplifier (figs. 8, 12 & 13), where it was raised to 200 kW if necessary. In the tests being carried out, only 60 kW were required. This current was then passed to the antenna. Among the features of the apparatus to which attention was called was the water cooling of the tubes in the various amplifiers, the rubber hose that carries the water serving also to insulate the anodes from earth, figs. 8, 10, 12 & 13. The receiving apparatus, Dr. Nichols explained, consisted of a receiving set operated from a loop antenna consisting of 50 turns of wire, the loop being about 6 ft. 6 in. square and grounded in the middle. For the purpose of getting better directional effect, the voltage was applied to the grid of the receiving tube from one half of the loop, so as to counterbalance the two vertical non-directional sides of the loop.

In the final portion of his lecture, Dr. Nichols showed curves taken of the signal strength across the Atlantic Ocean as received at New Southgate and also of the noises encountered (figs. 6 & 7). It was clearly seen from these how the strength of signal is greater at night, and was stated to be over 20 times stronger at 3 a.m. than on the previous afternoon.

Similarly, the variations in noise were plotted, and their effect at time was such as to reduce the intelligibility to 20 or 30 per cent. as against the average of 60 per cent. with wire telephony. The experiments had shown that reasonably intelligible speech could be transmitted from New York with 60 kW there for 14 or 16 hours of the day, although late in the afternoon on some days no signals came through at all. In the summer the noise increased enormously, and the worst period appeared to be July and August; it was for these reasons that the experiments were to be continued for a full year in order to determine all the data necessary to enable a transatlantic radio-telephone

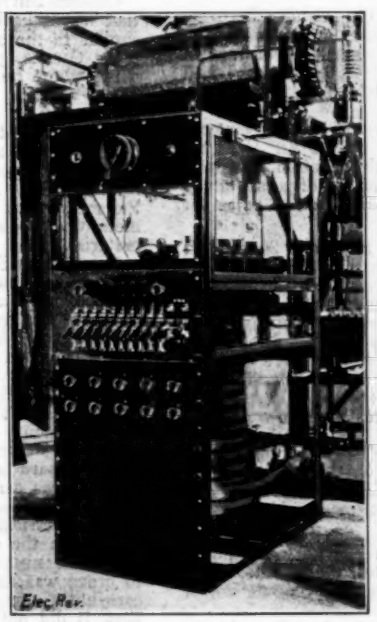

Fig. 12.

Fig. 13.

service to be engineered and maintained as a commercial proposition.

A short discussion followed the lecture, in which Mr. L. B. Turner, Dr. W. H. Eccles, Mr. E. H. Shaughnessy and Mr. H. E. Morrish took part.

Dr. Eccles said this work was the result of many years' experimenting, dating back to 1913, continued with very great scientific skill chiefly at the hands of Dr. Nichols. He regarded the curves of day and night signal strength which had been exhibited as of profound importance to all who had to design wireless stations and circuits.

Mr. Shaughnessy said the point of importance to him in the lecture was the method of sending only half the band, and by that means economising so much in power; measurement on both sides would have to be made with transmission in both directions before they could get all the data needed.

Mr. Morrish asked as to the possibility of producing greater directional effect by the erection of screens so that, for instance, signals intended for this country should not disturb communication between New York and Japan.

Dr. Nichols briefly replied, and explained that, technically, such screening structures could be erected, but financially it was quite another matter.

PARLIAMENTARY NOTES.

[By our Special Parliamentary Reporter.]

Private Bills. — The Metropolitan Railway (Various Powers) Bill; the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Bill; and the Wimbledon and Sutton Railway Bill have been read a second time in the House of Commons. The Felixstowe Dock and Railway Bill; the Great Western Railway (Additional Powers) Bill; the London & South Western Railway Bill; the London Electricity Supply Bill; the Midland Railway Bill; the North-Eastern Railway Bill; the Oakham Gas and Electricity Bill; the Shropshire, Worcestershire and Staffordshire Electric Power Bill; and the Swanage Gas and Electricity Bill have been read a first time in the House of Lords.

Trade Disputes.—On February 14th, Major Boyd Carpenter informed Mr. Hancock that the approximate number of working days lost by trade disputes in Great Britain and Northern Ireland in 1922 was 19,900,000. The number of workpeople involved in these disputes was approximately 555,000. Disputes involving less than 10 workpeople, and those lasting less than one day, were not included in these figures unless the aggregate duration (*i.e.*, the number of workpeople involved, multiplied by the number of working days) exceeded 100 days. No statistics were available as to the number of working days lost, owing to disputes, at establishments other than those directly affected by the disputes.

Fog Dispersion.—On February 22nd, Commander Bellairs asked the Secretary of State for Air whether he was willing to carry out experiments over London or along the railways in fog dispersion, such as had been carried out with alleged success by the American Army Air Service with sand electrically charged from aeroplanes.

Sir S. Hoare replied that full particulars of the experiments in America had already been called for by the Air Ministry, but had not yet been received. He might mention, however, that certain methods had been evolved for the dispersal of fog in a small confined space, but they did not appear to be as yet suitable for application on a large scale.

Underground Railway Fares.—On February 22nd, Mr. Gilbert asked the Parliamentary Secretary to the Ministry of Transport whether he had received a report from the Railway Rates Tribunal on the inquiry his department ordered last year on the fares of the London Underground railways; had he received any report from the London Electric Railway Company showing what reductions it brought into force on both its railways and tramways on January 1st last; and, if so, would he also publish this report with the other one so that London passengers might know what fares were now in force on these railways and tramways.

Colonel Ashley said that he had asked the company for information as to the final results of working for the year 1922 and as to the effect of the reduction in fares. So soon as this was available, the Rates Advisory Committee would be asked to report in discharge of its reference.

Engineering Goods for Russia.—On February 26th, Mr. Burgess asked the President of the Board of Trade, if he would state what was the value of engineering goods which were exported to Russia in 1912 and 1913.

Sir W. Joynson-Hicks, who replied, said that the value of machinery of all kinds (including locomotives, electrical machinery and marine engines), of United Kingdom manufacture, consigned to Russia amounted to £2,821,000 in 1912, and to £4,136,000 in 1913.

Miners' Electric Lamps.—On February 26th, Mr. Grattan Doyle asked the Secretary for Mines, whether his attention had been drawn to the investigations carried out by the Institute of Industrial Psychology as to the effect on coal production of increasing the lighting power of the miners' electric lamp.

Lieut.-Col. G. R. Lane-Fox replied that the results of these experiments were being closely studied. The Miners' Lamps Committee, who had been at work for the past two or three years, had already evolved two new types of electric lamp and published other valuable suggestions.

On February 26th, Sir Harry Brittain asked the Secretary for Mines, whether he had received a report from the Miners' Safety Lamp Committee; and, if so, whether it was his intention to publish the findings of the committee.

Lieut.-Col. G. R. Lane-Fox said that six memoranda presented by this Committee had been published by the Stationary Office, and also the minutes of evidence. A further report from the Committee was expected shortly, and when received, would be published without delay.

Patent Fuel Industry.—On February 26th, Mr. Mardy Jones asked the Secretary for Mines whether his attention had been called to the serious plight of the patent fuel industry in South Wales, owing to the high price of pitch, which was due to the abnormal use of pitch for road making resorted to by local authorities who could utilise satisfactory substitutes.

Lieut.-Col. G. R. Lane-Fox said he was aware of the facts stated in the question; the patent fuel manufacturers were taking the matter up with County Councils.

Broadcasting Parliamentary Debates.—On February 26th, Mr. Tillett asked the Prime Minister whether he would consider the practicability of arranging for the proceedings of the House of Commons to be broadcast in order that there might be closer touch between Parliament and the people.

Mr. Bonar Law replied that he did not think the hon. member's proposal was desirable.

LEGAL.

Bath Electric Tramways Co., Ltd., Summoned.

At Bath, on February 22nd, the Bath Electric Tramways Co., Ltd., was summoned for having allowed a workman to use a portable electric lamp, at a pressure above 150 volts, which was liable to become charged, and therefore contrary to Home Office regulations.

Mr. Joseph Owner, H.M. Inspector of Factories, explained the apparatus to the Bench, and a comparison was made with a standard safety hand lamp, the whole of the metal work of which was shrouded by a vulcanite covering.

Henry Whitmore, an electrician in the company's repair shop, said the voltage of the mains in the repair shop was 550.

Charles Sheppard, machinist in the company's employ, said that when the Inspector called he had in use a portable lamp similar to the one described as being of the non-safety type.

Mr. Owner, giving evidence, described his visit to the repair shop, where he found the witness using a hand lamp devoid of any earthing arrangements. He also found that four 135-V lamps were in series, and that it was possible for Sheppard to have received a severe shock if the metal-work had become charged. In the past few years he had investigated several accidents to workers using lamps of this type, including one fatal accident. A lamp could be made safe either by earthing the metal-work with an independent earth wire, or by the metal-work being effectively protected by some insulating material.

Mr. Gilbert Scott Ram, H.M. Principal Electrical Inspector of Factories, also gave evidence, and said that he had personally brought the requirements of the regulations before the notice of the general manager, Mr. Hardy.

Mr. Long informed the Bench that for the past 12 months Mr. Hardy had been trying to find a lamp which would be satisfactory for his work and in accordance with the requirements of the Home Office. There had been no wilful intention on his part to sweep aside the regulation for the safety of his workmen. He asked for the summons to be dismissed, because (1) there was no evidence to show that the Inspector saw Sheppard using the lamp; and (2) there was no evidence that he was using the lamp at a pressure above 150 volts.

Mr. Owner submitted it had been proved by the evidence of the electrician in charge, Whitmore, that there was 550 volts upon the circuit.

The Chairman informed the Inspector that what he had to prove was that the particular lamp which was in use was carrying a pressure above 150 volts. Unless he could prove that, it did not seem any good going on with the case.

Mr. Owner went on to argue in respect of the circuit, but the Chairman said that in the opinion of the magistrates the summons referred to the lamp and not to the circuit. After further contention on the point, the Chairman said that on the evidence given the case would be dismissed. The Inspector was given permission to appeal if necessary on the interpretation of the Home Office regulation named. The Bench would not make an order for costs.

Fellows Magneto Co., Ltd., v. Mica and Micanite Supplies, Ltd.

The defendants in the above case, who obtained judgment in their favour, are not satisfied that justice was done to them in the report of the case which appeared in our issue of February 16th. They state that their main defence was that the goods supplied were quite up to the standard of previous deliveries. The fact that the plaintiffs' inspection was made some months after delivery was only a subsidiary point.

Standard Electric Sign Co., Ltd.

(Compulsory Winding-up Order.)

A petition by H. J. Davis, a judgment creditor of the Standard Electric Sign Co., Ltd., for an order to wind up the company compulsorily came before Mr. Justice Astbury in the Companies' Winding-up Court on February 20th.

Mr. Bovill, for the petitioner, said the petition had been standing over to enable the solicitors for his client to ascertain whether there were genuine negotiations going on as had been alleged. They were distinctly of opinion that there was none, and, in addition, they had found that during the adjournment the company had purported to issue a debenture. He therefore asked his Lordship to make the order.

Mr. Carr, for the company, said the negotiations were still going on. He had an affidavit by the managing director, which showed that in a very short time the matter could be settled, and he would then be in a position to hand over to the petitioner's solicitors £500 for distribution if the matter went through, otherwise it would be returned to the purchaser if the contract went off. The matter was still the subject of genuine negotiations, and an agreement had been prepared which he understood was in Court.

Mr. Bovill said there was nothing in this. The company produced to the petitioner's solicitors a blank contract, and they told them the name of a proposed purchaser. They refused the solicitors permission to communicate with the proposed purchaser, and said they would get the document signed and bring it back. That was on February 12th, but they had not done so, and they had issued a debenture in the meantime.

Mr. Carr said the petitioner had put in an affidavit, which was sworn only on the previous day, and it dealt with matters of which the company had no knowledge.

Mr. Hunt said he appeared for the Mayor and Corporation of West Hartlepool, large judgment creditors, and he supported the petition.

His Lordship said he thought there had better be an order, and he made the usual compulsory order.

British Thomson-Houston Co., Ltd., v. Brachelloyd Supply Co., Ltd.

Mr. Justice Romer, in the Chancery Division, on February 21st, granted to plaintiffs injunctions restraining the defendants, of Worcester Street, Birmingham, from infringing two of their patents, *viz.*, for improvements relating to evacuated vitreous containers having sealed-in conductors, and for improvements in incandescent electric lamps.

There was no appearance for the defendants.

Noise or Vibration Case Fails.

At Edinburgh a tenant in the Sheriff Court sought an interdict against a baker on the ground that certain machinery, belonging to him, was an annoyance. The Sheriff, finding for defender, who had installed in the basement of his premises a 2-h.p. electric motor, said the real complaint was the early hour at which the machine was started. Any noise it might make later in the day was masked by street traffic. The defender had stated that any restriction upon the earlier hours of working would destroy the utility of the machine, and the Sheriff pointed out that there were a number of machines of this type in a similar class of property in Edinburgh and Glasgow. No complaints had been received. Pursuer had failed to prove that the noise or vibration was such as to cause the inmates of the house discomfort or annoyance.

Barr v. Shersby-Harvie and Others.

According to a Scottish newspaper, Sheriff Shennan in Hamilton Sheriff Court has disposed of two actions arising out of the tenancy of Millburn House, Dalserf. In the first case James Barr, coalmaster, 86, St. Vincent Street, Glasgow, sued Robert Shersby-Harvie and others, the tutors nominate of Miss Elspeth Campbell Hamilton, of Dalserf, the owner of the mansion, for £91 10s., the price of certain electric plant and heating apparatus, which he claimed he had sold to the defenders when he left the house on the completion of his lease at Whit-Sunday, 1922. The defenders counter-claimed for the price of certain switches, blocks, and wiring which, they averred, pursuer had wrongfully removed, and also for the damage done by him in the removal. His Lordship finds that the value of the articles sold by the pursuer to the defenders is £91 10s., and that the defenders have established a counter-claim of £21. He accordingly decerns in the pursuer's favour for £70 10s. His Lordship says that where the parties parted company was in the definition of "internal electric fittings." The pursuer believed that these included switches and blocks, which the defenders declared were heritable fixtures, for which they could not be asked to pay. The Sheriff says his inclination is strongly in favour of accepting this view.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

3,673. "Permutation lock for electric globes, &c." L. W. Hughes. February 7th.
3,675. "Crystal detectors." R. M. Abraham. February 7th.
3,679. "Submarine cables." Muirhead & Co., Ltd. February 7th.
3,683. "Burglar or fire alarms." G. J. Brown. February 7th.
3,699. "Couplings for connecting aerials to radio apparatus, &c." A. C. Greene. February 7th.
3,708. "Telephone receivers, relays, &c." G. C. Beddington. February 7th.
3,725. "Method of renewing filaments of thermionic valves." P. V. Castell-Evans and J. M. Longe. February 7th.
3,730. "Telegraphy and telephony." H. Caen. February 7th.
3,750. "Tuning coils for wireless telegraphy, &c." W. H. Hunter. February 8th.
3,760. "Apparatus for obtaining steady current from electric lighting circuits." E. E. Fournier d'Albe. February 8th.
3,773. "Electrically-driven trucks." J. R. Oliver and J. E. Stott. February 8th.
3,789. "Apparatus for electrolysing fused salts of metal, recovering the metals and acid radicles, &c." E. A. Ashcroft. February 8th.
3,790. "Electric vacuum tubes, &c., for advertising." E. V. Hayes-Gratze. February 8th.
3,796. "Wireless telegraphy, &c." H. Booth. February 8th.
3,798. "Illuminated display devices." New Electra Sign Co., Ltd. February 8th.
3,806. "Alternating-current commutator motors." Electro Dynamic Construction Co., Ltd., and N. Pensabene. February 8th.
3,807. "Pins for electric plug connectors, &c." C. L. Arnold and C. R. Belling. February 8th.
3,810. "Magnetic-electric ignition and lighting apparatus." G. Unterberg. February 8th.
3,822. "Illuminated signs." W. Laffan and J. B. A. E. Peranne. February 8th.
3,834. "Box or carton for electric lamps, &c." R. Hunt. February 8th.
3,841. "Control of wireless receiving apparatus." C. F. Elwell, Ltd., and K. Wilson. February 8th.
3,844. "Hydro-electric installations." A. Huguenin. February 8th. (Switzerland, March 21st, 1922.)
3,852. "Electric lighting switches for road vehicles." G. A. Smith. February 9th.
3,878. "Wireless amplifier switch and filament resistance combination." L. W. Burcham. February 9th.
3,879. "Screen lock for block telegraph instrument," E. A. Knopp. February 9th.
3,881. "Anti-dazzle vehicle lamp." W. F. Luff and A. W. Turner. February 9th.
3,894. "Electric tumbler switches." R. A. Macaulay. February 9th.
3,919. "Holders for thermionic tubes, &c." R. E. Beswick and Beswinning's. February 9th.
3,943. "Telephone receivers, &c." British Thomson-Houston Co., Ltd., and R. C. Clinker. February 9th.
3,944. "Electro-mechanical telephone systems." H. Baron (F. Aldendorff). February 9th.
3,945. "Insulators." British Thomson-Houston Co., Ltd. (International General Electric Co.). February 9th.
3,946. "Insulating cap for electric cable joints." F. M. van Gelderen. February 9th.
3,948. "Resistance switchboard for charging electric accumulators." R. I. Atherton. February 9th.
3,952. "Automatic, &c., telephone exchanges." G. H. Janson. February 9th. (Sweden, February 9th, 1922.)
3,961. "Device for learning Morse signals." J. A. Best. February 9th.
3,970. "Anti-dazzle head-lights." T. J. Eley and J. Goodwin. February 10th.
3,989. "Attachment to acetylene burners, &c., for electric ignition." J. R. D. Bridger. February 10th.
4,018. "Receiving apparatus for wireless telegraphy, &c." A. E. Southerton. February 10th.
4,020. "Method of fixing attachments to mouthpieces of telephone transmitters." H. E. Simpson. February 10th.
4,023. "Switching apparatus for telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). February 10th.
4,039. "Wireless apparatus." J. Hetherington. February 10th.
4,040. "Eliminating disturbance in reception of wireless signals, &c." V. Kulebakin. February 10th.
4,051. "Supports for wireless aerials." H. R. Rivers-Moore and R. M. Radio, Ltd. February 10th.
4,052. "Electric incandescent lamp." G. M. Howard. February 10th.
4,054. "Apparatus for wireless telegraphy." W. C. Davey. February 10th.
4,066. "Wall plugs for electric services." E. S. Wilding. February 12th.
4,071. "Electric batteries." J. Eaton and Efandem Co., Ltd. February 12th.
4,081. "Sound recording and reproducing means." R. B. G. Greig and J. Sperni. February 12th.
4,082. "Keyboard for transmitting Morse code." R. F. Spiller. February 12th.
4,094. "Electric junction boxes." Grierson Bros., E. Grierson, and J. W. Grierson. February 12th.
4,101. "Wireless systems and apparatus." W. H. Derriman and J. Robinson. February 12th.
4,102. "Horns for sound projection, &c." Telephone Manufacturing Co., Ltd. February 12th.
4,103. "Telephone receivers." J. Erskine-Murray and Telephone Manufacturing Co., Ltd. February 12th.
4,104. "Manufacture of small glow lamps." Naamlooze Vennootschap Pope's Metaaldraadlampenfabriek. February 12th. (Holland, March 8th, 1922.)
4,105. "Manufacture of electric lamps." Just Féle Izzólámpa és Villamossági Gyár Résvénytársaság. February 12th. (Hungary, February 27th, 1922.)
4,106. "Re-magnetising flywheel magnets of motor vehicles." H. L. Hannaford. February 12th.

4,108. "Electric signalling device for motor vehicles." N. H. Fleming. February 12th.
4,121. "Electrodes." W. G. Moore. February 12th.
4,124. "Sparking plugs." British Thomson-Houston Co., Ltd. (General Electric Co.). February 12th.
4,131. "Method of cooling turbine-driven dynamo-electric machines." W. Bartel and O. Happel. February 13th. (Germany, December 20th, 1920.)
4,132. "Connecting devices for radio receiving systems." W. Dubilier. February 12th.
4,142. "Electric condenser." E. Pfiffner. February 12th. (Germany, February 10th, 1922.)
4,143. "Arrangement for preventing marginal discharge in electric condensers, &c." E. Pfiffner. February 12th. (Germany, February 11th, 1922.)
4,166. "Crystal cup and holders." M. Anthony. February 13th.
4,167. "Wireless telephony." E. R. Hazzard and J. H. Hazzard. February 13th.
4,173. "Electric motor starters." Brook, Hirst & Co., Ltd., and J. A. Hirst. February 13th.
4,181. "Masts for wireless aerials." Accles & Pollock, Ltd., and W. W. Hackett. February 13th.
4,191. "Electric stoves, radiators, &c." H. P. Girling. February 13th.
4,197. "Means for insulating, &c., electric fittings." J. Appleby, A. Charles, and J. E. Sidwell. February 13th.
4,200. "Electric radiator." T. Cooper. February 13th.
4,202. "Electric switches, cut-outs, &c." E. C. Forster. February 13th.
4,231. "Telephone exchange apparatus." H. F. Trewman. February 13th.
4,243. "Telephones." F. Baker, E. A. Petithory, and Siemens Bros. and Co., Ltd. February 13th.
4,256. "Ignition distributors for internal-combustion engines." J. Withey. February 13th.
4,260. "Posts for electric conductors, &c." Himmelsbach Akt. Ges. Geb. February 13th. (Germany, July 10th, 1922.)
4,265. "Electric trolley wire suspension means." L. C. Partington. February 13th.
4,283. "Lock for electric globe and holder." A. E. Richards. February 13th.
4,284. "Sparking plugs." Sir W. Peck. February 13th.
4,297. "Electro-mechanical apparatus for transmission of information, &c." S. A. Fox and C. H. Offord. February 14th.
4,323. "Dynamometers, &c." Heenan & Froude, Ltd., and G. H. Walker. February 14th.
4,333. "Electric semaphore signalling." A. E. Thresh. February 14th.
4,345. "Receiving apparatus for wireless telegraphy, &c." J. Erskine-Murray and C. Seymour. February 14th.
4,347. "Automatic trip mechanism for electric circuit breakers." A. E. Angold, A. H. Railing, and H. C. Turner. February 14th.
4,354. "Protective apparatus for electric circuits." Metropolitan-Vickers Electrical Co., Ltd., and T. W. Ross. February 14th.
4,355. "Vacuum electric tubes." E. Y. Robinson. February 14th.
4,357. "Electron discharge devices." British Thomson-Houston Co., Ltd. February 14th. (United States, February 28th, 1922.)
4,363. "Röntgen-tube apparatus." C. H. F. Müller. February 14th. (Germany, January 22nd.)
4,371. "Telephone systems." Relay Automatic Telephone Co., Ltd. February 14th. (Sweden, March 22nd, 1922.)
4,372. "Sound-reproducing apparatus." Aeolian Co., Ltd., and C. K. Sugden. February 14th.
4,388. "Telautography, photo-telegraphy, &c." H. G. Bartholomew and M. L. D. McFarlane. February 14th.
4,389. "Telautography, photo-telegraphy, &c." H. G. Bartholomew and M. L. D. McFarlane. February 14th.
4,393. "Circuit-controlling devices." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 14th.
4,430. "Electric switches." R. A. Macaulay. February 15th.
4,440. "Loud-speaking gramophones for wireless telegraphy, &c." H. B. Sykes. February 15th.
4,462. "Portable electric lamps." M. Zeiler. February 15th.
4,474. "Electric switches." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. February 15th.
4,481. "Electro-deposition of metals." S. O. Cowper-Coles. February 15th.
4,482. "Rendering weak currents effective to influence electrical apparatus." H. St. G. Anson. February 15th.
4,493. "Electric indicators and recorders." Elliott Bros. (London), Ltd., and W. Phillips. February 15th.
4,497. "Sparking plugs." H. Ford. February 15th.
4,502. "Portable apparatus for producing and applying electric current for therapeutic purposes." C. Firpo. February 15th. (Italy. July 24th, 1922.)
4,506. "Telephone receivers." W. E. Gower and S. M. Greening. February 15th.
4,508. "Terminals for electric conductors." C. M. Boyce. February 15th.
4,517. "Thermostatic devices for controlling electric circuits." I. Hall and A. S. Salas. February 15th.
4,518. "Wireless receiving apparatus." F. A. Pereira. February 16th.
4,524. "Magneto conversion set." A. Gamblin and Ipswich Industrial Co-operative Society, Ltd. February 16th.
4,540. "Adaptable electric fire." J. A. Getty. February 16th.
4,545. "Means for introducing capacity effects in alternating-current systems." T. F. Wall. February 16th.
4,553. "Electric incandescent lamps." T. Greenwood. February 16th.
4,562. "Control of electric motor generator sets." E. I. David. February 16th.
4,570. "Electric starting mechanism for internal-combustion engines." P. J. Beddons, and C. A. Vandervell & Co., Ltd. February 16th.
4,579. "Electric lamp lock." G. Derham, C. B. Millett, J. R. D. Norie, and C. H. T. Pelmear. February 16th.
4,584. "Transformer for wireless receivers." J. W. Gaylor and A. C. Mark. February 16th.
4,586. "Electric contacts." J. B. Bolitho. February 16th.
4,597. "Box for electric lamps." R. Hunt. February 16th.
4,601. "Electro-plating apparatus." C. B. Appleby, Colman & Appleby, Ltd., and O. J. Neale. February 16th.
4,604. "Safety device for protecting valve filaments of wireless apparatus." A. H. Hunt. February 16th.
4,606. "Electric lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 16th. (Holland, February 17th, 1922.)
4,610. "Aerials for wireless telegraphy, &c." J. Wass. February 16th.
4,613. "Wireless apparatus." M. Billington. February 16th.
4,617. "Wireless receiving apparatus." J. W. Barber. February 16th.
4,629. "Arrangement for operation of luminous discharge tubes." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Gluhlampen). February 16th.
4,630. "Electrodes for electric discharge devices." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Gluhlampen). February 16th.
4,636. "Electric commutator for internal-combustion engines, &c." T. D. Taylor. February 17th.
4,637. "Sparking plugs." W. Roberts. February 17th.
4,647. "Electric motor control." J. A. Baker, W. Edwards, and L. Etheridge. February 17th.
4,665. "Sparking plugs." P. M. Brookes. February 17th.
4,667. "Crystal holder for wireless telephony." G. E. Mallett. February 17th.
4,680. "Multi-core cables for high-frequency telephony, &c." B. E. D. Kilburn (Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij). February 17th.
4,682. "Impulse starting mechanism for ignition magnetos." E. Carter and F. Carter. February 17th.
4,683. "Electric plug-and-socket connectors." A. N. Penman and D. Smith. February 17th.
4,685. "Stands for gas and electric sad-irons, &c." S. M. Munro. February 17th.
4,694. "Electric switches." H. Garde. February 17th.
4,704. "Electrodes for electric discharge devices." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Gluhlampen). February 17th.
4,708. "Radio-telephony receiving apparatus." G. C. Barclay and H. T. R. Cripps. February 17th.
4,713. "Electric switch mechanism." A. C. Day. February 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

21,010. "Wireless receiving systems and the like." J. Scott-Taggart and Radio Communication Co., Ltd. August 8th, 1921. (192,429.)
22,369. "Headlights." E. P. Bone. August 23rd, 1921. (192,430.)
25,598. "Electric phase regulating devices." H. Baron (Signal Ges.). September 27th, 1921. (192,439.)
26,477. "Manufacture of railway and tramway rails." C. P. Sandberg. October 6th, 1921. (192,446.)
27,566. "Vapour lamps." C. V. Richardson. October 17th, 1921. (191,824.)
28,074. "Portable electric hand lamps." Cable Accessories Co., Ltd., F. H. Reeves, and P. W. Davis. October 22nd, 1921. (192,449.)
28,790. "Apparatus for the production of high-frequency oscillations by means of alternating current of low frequency." H. Sefton-Jones (C. Lorenz Akt. Ges.). October 29th, 1921. (192,460.)
28,791. "Method of increasing frequency by means of static transformers." H. Sefton-Jones (C. Lorenz Akt. Ges.). October 29th, 1921. (192,461.)
28,848. "Dynamo-electric machines." G. Somajni. October 30th, 1920. (170,863.)
28,871. "Thermionic valve for use more particularly in wireless telegraphy or telephony." W. R. Bullimore. October 31st, 1921. (192,464.)
28,880. "Electric time switches." E. H. Horstmann, A. Horstmann, and Horstmann Gear Co., Ltd. October 31st, 1921. (192,465.)
29,010. "Closed circuit relays." Siemens & Halske Akt. Ges. December 11th, 1920. (172,935.)
29,022. "Thermionic valves or the like." W. R. Bullimore. November 1st, 1921. (192,476.)
29,139. "Storage batteries." Three Star Accumulators, Ltd., and F. C. Grund. November 2nd, 1921. (192,484.)
29,165. "Wireless receiving systems." Ges. für Drahtlose Telegraphie. November 24th, 1920. ((171,983.)
29,167. "Signalling by high-frequency oscillations over line wires." Dr. E. F. Huth Ges. and K. Schwarz. November 2nd, 1920. (171,697.)
29,755. "Automatic glass-working machines." British Thomson-Houston Co., Ltd. (General Electric Co.). November 8th, 1921. (192,508.)
30,152. "Tapping switches for changing voltage ratios of transformers or the like." S. A. Stigant, E. Barton, and Johnson & Phillips, Ltd. November 11th, 1921. (192,518.)
30,192. "Electric cycle lamps." C. A. Miller and F. J. Miller. November 12th, 1921. (192,519.)
30,327. "Electric terminals." British Thomson-Houston Co., Ltd. (General Electric Co.). November 14th, 1921. (192,521.)
31,538. "Thermionic oscillation generators." Ges. für Drahtlose Telegraphie. January 11th, 1921. (174,043.)
31,568. "Magneto-driving devices for internal-combustion engines." R. Bosch Akt. Ges. November 25th, 1920. (172,026.)
34,981. "Electric warp stop-motions for looms." C. Bourgeois. January 13th, 1921. (174,335.)

1922.

19. "Mine-signalling apparatus." Clay Cross Co., Ltd., and J. W. Strong. January 3rd, 1922. (192,564.)
86. "Intermittently-operating electric circuit closing devices." C. J. Evans. January 3rd, 1922. (192,565.)
297. "Controlling devices for electric locomotives." E. C. R. Marks (Goodman Manufacturing Co.). January 4th, 1922. (192,573.)
510. "Composition suitable for making, and a method of manufacture of sound amplifiers or horns for talking machines." J. L. Mathieu and A. Benoit. January 6th, 1922. (192,575.)
1,210. "Spark plugs for internal-combustion engines." G. P. Ribis. January 13th, 1922. (192,583.)
1,459. "Air connections for electro-magnetically-actuated valves." N. E. North, J. P. Campbell, and Metropolitan-Vickers Electrical Co., Ltd. January 17th, 1922. (192,587.)
1,610. "Electric fuse box." G. H. Scholes, A. W. Claremont, and L. B. Claremont (legal representatives of E. A. Claremont (deceased)). January 19th, 1922. (192,589.)
1,648. "Spring contacts for electric switches, fuse holders, and the like." A. C. Smith. January 19th, 1922. (Cognate application, 27,918/22.) (192,590.)
2,152. "Thermionic valves for wireless telegraphy and telephony." L. G. Preston, B. Hodgson, and H. G. Hughes. January 24th, 1922. (192,592.)
3,129. "Telephone systems." Siemens & Halske Akt. Ges. February 19th, 1921. (175,612.)
3,723. "Electric switches." H. H. Berry and Berry's Electric, Ltd. February 8th, 1922. (192,614.)
4,816. "Sparking plugs." F. W. Dixon and W. Danby, Junr. February 18th, 1922. (192,619.)
8,243. "Method of, and apparatus for measuring the intensity of cross-talk between the lines of a multiple-wire telephone system." Felten and Guilleaume Carlswerk Akt. Ges. May 26th, 1921. (180,635.)
8,303. "Electric welding and heating devices." E. Schröder. March 22nd, 1922. (192,636.)
8,787. "Systems of electrical distribution." Metropolitan-Vickers Electrical Co., Ltd. June 3rd, 1921. (180,984.)
17,428. "Process for the manufacture of the coating of the dielectric of condensers." E. Pfiffner. July 5th, 1921. (182,780.)
18,222. "Submarine cables." Western Electric Co., Ltd. August 16th, 1921. (184,782.)
25,487. "Electric discharge tubes with two or more electrodes." Dr. G. Holst and Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 26th, 1922. (192,673.)

1923.

148. "Electric power transmission systems for vehicles." J. B. Entz. November 5th, 1920. (Divided application on 171,090.) (191,084.)

Chief Technical Assistants' Association.—The annual general meeting of the Association will be held at 5 p.m. on March 3rd, and will be followed by the annual dinner at 6.15 p.m. The meeting arranged for March 8th, has been cancelled.